

VOLUME 45

NUMBER 3



Keep Your Copies of Nature Magazine in this Fine Binder!



PRICED LOW

At \$3.00

Personalize Your Volume
(Extra)

Your name in Gold	20c
Your or Vol. number	50c
Both for	1.20

Your money will be
refunded if you are
not entirely satisfied

**OPENS FLAT
LIKE A BOOK.**



NATURE MAGAZINE never grows old. It is more than a magazine; it is an encyclopedia of information on nature subjects, presented as attractively as fiction and illustrated so aptly as to make you a witness of the endless procession of nature happening. Every issue of the magazine is worth keeping and reading again and again.

Thousands of subscribers bind their copies for the permanent preservation of the wealth of factual information they contain.

For your convenience and pleasure, we have selected the very best binder we could find. It is a handsome, finely grained dark green, gold-embossed binder — a creditable addition to any reading table or library. It is light, strong, and durable. Copies of the magazine can be inserted, one at a time, without cutting or punching, simply by the snap of a little unbreakable wire. And, best of all, it opens flat like a bound book which makes it easy to handle and to read.

Each binder will hold the issues of NATURE MAGAZINE for a full year — or as long as you wish to retain them in the binder. Meanwhile the contents are protected from handling, tearing and from being mislaid or carried away. Get greater enjoyment out of your magazines by binding them and by so doing make distinctive and welcome additions to your library. You can, in time, acquire a reference library on nature subjects beyond compare.

Mail your order with remittance to

AMERICAN NATURE ASSOCIATION

1214 16th St., N. W.

Washington 6, D. C.

Mexico and Birds

Mexican Birds. By George Miksch Sutton. Norman, Oklahoma. 1951. University of Oklahoma Press. 282 pages. Illustrated in color and black and white by the author. \$10.00.

Here is a book that every bird enthusiast will want. It is an account of first impressions by the author on an ornithological expedition to Tamaulipas, Nuevo León, and Coahuila, Mexico. Supplementing the story of this expedition is an appendix briefly describing all Mexican birds. The account of the expedition, which occupies the first 186 pages of the book, is fascinating reading and makes the reader feel as though he were along — or at least wish that he had been. The author has the seeing eye for other things of Nature besides the birds, for he can stop to record the activities of colonies of leaf cutting ants here, and note interesting activities of the natives there. Thus we have a volume for reading and a volume for reference, all in one.

Guide to the Heavens

The Heavens Are Telling. By Urana Clarke. Riverdale 71, New York. 1951. Acorn House. 128 pages. Illustrated by Michael Chanwick. \$2.95.

The author of this attractive and valuable book is an amateur astronomer but one who has served as a guest lecturer at the Hayden Planetarium, and whose interest in astronomy has been of long standing. In this book she seeks to answer questions that she has asked herself and that many others have asked her. She does so through a readable and non-technical text that proves an admirable introduction to astronomy. The book is splendidly arranged, chapters starting first with the sky, then the universe, then dealing with their component parts. Anyone taking up astronomy as a hobby will find this book a fine aid.

Wildlife in Color

Wildlife in Color. Text by Roger Tory Peterson. Boston. 1951. Houghton Mifflin Company. 192 pages. With 453 illustrations in color by America's leading wildlife artists. \$3.00.

Since 1938 the National Wildlife Federation has annually been issuing sets of beautiful color pictures in detachable stamp form, selling them as a means of financing its work. Now, under the sponsorship of the Federation, 453 of these subjects — birds, mammals, butterflies, reptiles, trees and flowers — have been gathered together into this book. Roger Peterson, who is responsible for many of the pictures, has worked out an excellent text, presenting it from the ecological point of view. For example, chapters deal with wildlife near home, wildlife found in deciduous woodlands, in the north woods

country, wildlife of swamps and fresh marshes, of the coast and sea, and so on. The ensemble makes a colorful, valuable and interesting book.

Adult Study Camps

Adult Study Camps. Compiled by Margaret Willis and Mary J. Alton. Louisville 2, Kentucky. 1951. Franklin Printing Co., 416 W. Main St. 85 pages. Illustrated. \$2.00.

Convinced that the many educational camps for adults offer a splendid way for one to enjoy both an enjoyable and educational vacation experience, the authors of this booklet spent two years gathering the information and pictures so that the data could be made available all in one place. They have succeeded admirably and the camps discussed cover such subjects as music, archaeology, education, nature study, zoology, audio-visual aids, work, biology, photography, geology, conservation, geography, engineering, leadership, folk dancing and arts and crafts. We believe that this work will be widely welcome, and also believe that it will bring to light additional information that one of these days will require a new edition and a larger one.

Ducks, Geese and Swans

Life Histories of North American Wild Fowl — Ducks, Geese and Swans. By A. C. Bent. New York. 1951. Dover Publications. Two volumes. \$8.00 the set.

The original volumes of these life histories as issued by the Smithsonian Institution are collector's items and difficult to come by. Even these reissues are in a limited edition of 1250 copies, authorized by the compiler. These new editions are complete and unabridged and include reproductions, unfortunately not quite as good as they might be, of the original plates. However, A. C. Bent's notable contributions to ornithological literature have been more highly valued for the amazing amount of information that he has assembled and organized than for the relatively incidental illustrations. Publication of these books will now enable many to fill out their library of Bent life histories.

Unusual in Nature

Animal Wonder World. By Frank W. Lane. New York. 1951. Sheridan House. 310 pages. Illustrated. \$1.00.

The author of this book has been writing about Nature for a number of years, and has been an occasional contributor to *Nature Magazine*. From his studies and his extensive correspondence he has assembled this book, which he subtitles "A Chronicle of the Unusual in Nature." It is a fascinating book to read because it is different and constantly surprising.



WINS DOUBLE-SUCCESS THROUGH N.I.A. TRAINING

"I was awarded third prize in the National Peace Treaty Contest. It was announced from the White House. The Fresno Labor Citizen has given me a by-line and is taking all my stories. Through the N.I.A. course I have learned to express myself simply and to the point." — Marjorie Drath, Rte. 1, Box 82, Parlier, Calif.

What Makes WRITING ability GROW?

For a number of years, the Newspaper Institute of America has been giving free Writing Aptitude Tests to men and women with literary ambitions. Sometimes it seems half the people in America who are fired with the desire to write have taken advantage of this offer to measure their ability.

What The Tests Show

Up to date, no one who could be called a "born writer" has filled out our Writing Aptitude Test. We have not yet discovered a single individual miraculously endowed by nature with all the qualities that go to make up a successful author. One aspirant has interesting ideas — and a dull uninteresting style. Another has great creative imagination, but is woefully weak on structure and technique. A third has a natural writing knack — yet lacks judgment and knowledge of human behavior. In each case, success can come only after the missing links have been forged in.

Here, then, is the principal reason why so many promising writers fail to go ahead. Their talent is one-sided — incomplete. It needs rounding out.

Learn To Write By Writing

NEWSPAPER Institute training is based on journalism — continuous writing — the sort of training that turns out more successful writers than any other experience. Many of the authors of today's best sellers are newspaper-trained men and women. One advantage of our New York Copy Desk Method is that it starts you writing and keeps you writing in your own home, on your own time. Week by week, you receive actual assignments just as if you were right at work on a great metropolitan daily.

All your writing is individually corrected and criticized by veteran writers with years of experience "breaking in" new authors. They will point out those faults of style, structure or viewpoint that keep you from progressing. At the same time, they will give you constructive suggestions for building up and developing your natural aptitudes.

In fact, so stimulating is this association that student members often begin to sell their work before they finish the course.

We do not mean to insinuate that they sky-rocket into the "big-money" or become prominent overnight. Most beginnings are made with earnings of \$25, \$50, \$100, or more, for material that takes little time to write — stories, articles on business, home-making, recipes, hobbies, chaper, sports, travel, nature studies, local and club activities, etc.—things that can easily be turned out in leisure hours and often on the impulse of the moment.

For Those Who Want To Know—Free Writing Aptitude Test

If you really want to know the truth about your writing ambitions, send for interesting Writing Aptitude Test. This searching test of your native abilities is free — entirely without obligation. Fill in and send the coupon. Newspaper Institute of America, One Park Ave., New York 16, N. Y. (Founded 1925).

VETERANS: COURSE APPROVED FOR VETERAN'S TRAINING

Free

Newspaper Institute of America
One Park Ave.,
New York 16, N. Y.

Send me, without cost or obligation, your Writing Aptitude Test and further information about writing for profit as promised in NATURE, January.

Mr. _____
Mrs. _____
Miss. _____

Address _____

City _____ Zone _____ State _____

(All correspondence confidential. No salesman will call on you) 87-A-432

Copyright 1951. Newspaper Institute of America

Mention NATURE MAGAZINE when answering advertisements

Nature in Print

By HOWARD ZAHNISER

"NATURE supplies the unity," writes Brooks Atkinson as he looks back over the year of his life from which he has derived his "book about America" called *Once Around the Sun*. We ourselves, he reflects, "supply the vast array of sentient details." His own chronicle of a year, with its "raw material that helps to illustrate life in America," its examples of the "millions of familiar things that affect us intimately and keep us patiently making the rounds from year to year," he presents as only "one of the countless patterns of life in a democracy." But he does this in thoughtful awareness that the unity of our diverse lives is in Nature, and he thus has written a book that is not only interesting as a sharing of the experiences of Brooks Atkinson but also profitable for reflection. "The annual cycle of the seasons is the common experience," he writes. "No one escapes the grand march of the year — winter, spring, summer, and autumn . . . — the grand cycle of the seasons year without end."

As he tried on New Year's Day to look "forward through the long, many-colored corridor of the year," Mr. Atkinson opened his record with the intention, "I think I shall keep a book of days to chronicle one year in the endless revolution of the universe — one human cycle in the myriad of cycles that reaches out an unimaginable distance into time, space, and poetry."

"Let me try," he resolved, "to put together a microcosm of type, ink, and paper — the small change of civilization. 'A day is the epitome of a year,' Thoreau said. A year is the epitome of a lifetime. A lifetime is the epitome of eternity. As the winters weigh on our shoulders and the springs lighten our hearts, we go on grinding up and storing away little fragments of eternity — idly sauntering through the seasons, looking, working, studying, talking, thinking, dreaming."

Thus he sets out to epitomize eternity with the "little fragments" from the life of one American in what appears from circumstantial evidence to be the year 1948. It is the life of the drama critic for *The New York Times*, a former book-review editor, a biographer and interpreter of Henry Thoreau, a former war correspondent at Chungking and in Moscow, recipient in 1947 of the Pulitzer Prize for Journalism. It is the life of a man "enchanted by birds and ships," a husband, the father of a nine-year-old girl, Heather, and a five-year-old boy, Andrew, a man interested in people — a man who confesses: "I like the warmth, brightness, confidence, and hope of the transcendentalist universe in which I am related to all men and all growing things and am not shut off from anything except by my own ignorance or the feebleness of my own vitality." It is a life lived, during the year of this chronicle, in a New York City Riverside Drive apartment and in a country home near Catskill, New York — by a New Yorker who classes himself with those "whose hearts are in the country," a countryman who exults also in the metropolis — a man who feels "thoroughly contented" waking to the sound

of rain not only when it is dripping at windows but also when it brings the sound of "automobile tires hissing on the wet pavement," a man who writes:

"I confess that Central Park is the only part of the city where I do not like to walk. It is the best the city can do in an admirable attempt to keep a few hundred acres open. Thousands of people use it gratefully. But it is counterfeit country; and to me insipid and less refreshing than the vibrant thunder of the traffic across Brooklyn Bridge or the tension and loquacity of the garment center, where the rights of man are fiercely argued during the lunch hour."

Once Around the Sun records not only the activities of its author and the observations he makes in city and country. Its 365 entries include also some nineteen succinct and penetrating sketches of men whose anniversaries are the days of these entries — in the order of their appearance: Thomas Jefferson, William Shakespeare, John James Audubon (with due regard for

Lucy Bakewell Audubon), Benjamin Franklin, Thomas Paine, Abraham Lincoln, George Washington, Andrew Jackson, Nathaniel Hawthorne, Ralph Waldo Emerson, Walt Whitman, Henry David Thoreau, George Bernard Shaw, Herman Melville, Nicola Sacco and Bartolomeo Vanzetti, Henry Hudson, John Brown, Theodore Roosevelt, and Mark Twain. What an excellent company! And with them the living people who also find their way into Mr. Atkinson's chronicle — Joe and Mrs. Berman at the newsstand, Mrs. Rabinowitz (Queen of the neighborhood, the wife of the tailor), the negro artist Beauford Delaney with his magnificence and "simple goodness," the compassionate dentist S. M. Frank, the negro about town Charlie Jenkins ("the most Christian man in town"), the suddenly appearing Eg Franklin whose genius it is "to fall into the rhythm of any household he visits," John Kieran the genial talking encyclopedia with a special devotion to bird lore, Judson Moss who has "sprinkled the whole" of the Atkinson's farm "with his own sweat," the talkative bearded artist Al

Hirschfield, Hyatt Field at the garage, the country storekeepers Ernest and Bertie Ford, Mr. Johnson the cigar-stand would-be farmer, George Dahl the retired ship's engineer who makes things ("the happiest man"), Mr. Kartevold the eighty-seven-year-old watchmaker, the visiting Cleveland critic Bill McDermott, the artists Boris and Lisa Aronson who "make a world of their own inside the visible universe that leaves most people at loose ends," the office secretary (whose name is not told), and "our housekeeper, Sue," who "represents the sorrowfulness of the Negro race in a white man's world."

"People are all right," declares Mr. Atkinson. "The world is full of trouble and alarm. But there is no real trouble with people taken on their own level as human beings." In Russia and China, "the only other countries where I have lived for any length of time," he testifies, the people "were as sound as Americans." With a troubled character in a play by Saroyan Mr. Atkinson agrees that "there's something wrong somewhere," but he confidently asserts, "It is not the people."

"Everyone dies a little when his neighbor is killed," Mr. Atkinson observes on another day, January 7. As I write these review paragraphs, on an Armistice Day Sabbath, conscious of their preparation for a January magazine with its New Years significance, this sentence goes deep, and the rest of its one-

The Lesser Things

By MAY BURNETT

Sometimes it seems that we are unaware
Of lesser things, so much the large joys
count,

Heed not soft winds nor frailest wings
that mount,

Or minute fret-work of small twigs
stripped bare,

Holding potential beauty's liberal share,
Etched on the frosted ground where moonlight's
spilt,

Nor insect homes that patience slowly
built;

Of all these wonders may we grow aware.

Held in the soft green clusters of the
moss,

To keener sight are tiny forms like trees,
And where the slender heads of grasses
toss,

There are real miracles within small things,
A web, the seeds, a tiny bird that sings.

paragraph entry for January 7 follows: "... No society is sound and vigorous enough to sustain death on the staggering scale that wars make inevitable. No one can win a war. There are survivors but no victors. It releases pestilences that infect everyone who is left. Since the nature of war is evil, it sows seeds of hatred, destruction, and suspicion everywhere and contaminates the moral life of those who think they have won as well as those who have lost. For the evil goes deep and produces epidemics of intolerance and witch-hunting, assassination of character, mass repudiation of intelligence, the murder of philosophy, surrender to despair, the abased acceptance of one more war as inevitable. Two world wars have written identical items in the Doomsday Book of America. How many times must they be repeated? After each war there is a little less democracy to save."

Thus are suggested some of the aspects of this book of program notes for the cycle of the seasons, which Mr. Atkinson has recorded, here commended especially for attention as once again we contemplate the concert of the months at the year's beginning. Not only in its consciousness of the unity given our lives by Nature, not only in its general awareness of the outdoors, is this *Once Around the Sun* volume of special interest to us. There are indeed many entire daily entries that are delightful and revealing brief essays on Nature, and some fifteen of them are "biographies" of birds as succinct and understanding as those that for other days describe Mr. Atkinson's roster of great men. Again in the order of their entry, these birds are: the tree sparrow, herring gull, white-throated sparrow, blackpoll warbler, bobolink, chimney swift, house sparrow, phoebe, Virginia rail, herons, hermit thrush, great horned owl, bluejay, bluebird, and chickadee. Other such sketches deal with lilacs, the wild rose, the black locust, woodchucks, deer, stars, and meteors. (One certainly wishes for an index!) Here certainly is a volume with a wealth of reading, and one that wakens a keen anticipation for another year ahead of us all.

What a fine prospect the year would indeed have for us all if we could look forward to following Edwin Way Teale's example, and, with the winter behind us, set forth to follow the spring awakening of the earth from its early beginnings in the South to its latest manifestations in the North. Mr. Teale's account of the 1947 spring and the journey that he and his good wife Nellie made during this season — from the Everglades to Mount Washington in New Hampshire, via all the "wild and remote places" they could bring into their itinerary — has just been published with the inviting title *North with the Spring*. "Ours would be no conventional tour," the Teales assured themselves. "We would see spring," he writes,

"come to dunes and tarns and seashell islands, to caves and underground rivers, to estuaries and savannahs. For 17,000 miles we would travel with the season. In 23 different states we would witness the defeat of winter, see the homecoming of the birds, watch the return of the wildflowers." Their expectations were realized with a great good fortune, and Mr. Teale's report on that long spring is a surpassingly interesting and satisfying example of his writings — complemented again with his excellent photographs. We shall be discussing *North with the Spring* on this page again, but — coming as it has with the seasonal emphasis of *Once Around the Sun* still in mind — it seems good to call it to attention at once. It would be an excellent Christmas present.

Once Around the Sun. By Brooks Atkinson. New York: Harcourt, Brace and Co. 1951. 376 pp. (5½ by 3½ in.), with 12 illustrations by Don Freeman. \$1.

North with the Spring: A Naturalist's Record of a 17,000-mile Journey with the North-American Spring. By Edwin Way Teale. New York: Dodd, Mead and Company. 1951. 366 pp. (5½ by 8½ in.), with 35 photographs on 31 plates, end-paper map showing the route of the journey, index, and appended selections from reviewers' comments on other books by Teale. \$5.

Missouri Valley

The Damned Missouri Valley. By Richard G. Baumbhoff. New York. 1951. Alfred A. Knopf, Inc. 291 pages. \$3.75.

The Missouri Valley comprises one-sixth of our nation. It is an area of varied natural forces surrounding the "Big Muddy." The author of this book is a star reporter on the staff of the *St. Louis Post-Dispatch*, and he has been long assigned to cover life and happenings in those States within the Missouri Valley. Tremendous programs are envisaged for this area, and much money and effort has already been expended in it. In this book the author seeks to give a picture of the region, its history and its potentialities, and to examine local, state and federal efforts to meet the challenge of erosion, flood and conservation of resources in the Valley.

Conservation Handbook

For fifty-five consecutive years Cornell University has helped rural teachers help students to better understand their immediate and remote environments through direct, first-hand experience. For forty-four years this has been done largely through the Cornell Rural School Leaflet. Now the forth-fifth year starts with the appearance of Volume 45, Number 1 of the leaflet, entitled "Conservation, A Handbook for Teachers." Copies are available to New York State teachers on request; to others at 25 cents a copy.

The spirit and face of the SOUTHWEST captured in magnificent

COLOR



64 pages of
full-color
paintings
by famous
western
artists

Here, reproduced in glowing, faithful color, are priceless treasures of art and Americana — paintings showing the cowboys, the Indians, the animals, and the vast and haunting landscape that make up the Western scene.

Just Published

GALLERY OF WESTERN PAINTINGS

Edited by Raymond Carlson
Editor of *Arizona Highways*

64 pages of full-color illustrations

20 pen-and-ink sketches

8 essays on the artists' lives and work

A true art treasure at only \$8.50

Here you will find, brought to life in the bright, strange colors of the western desert and mountains, the kind of scenes that have given the West such a hold on the imagination of our people — that have made it a name synonymous with adventure, vision, and courage. Here is dramatic action in pictures like that of the fight between two mustangs... a spirit of hope in a wagon train winding across unmarked prairies... a deeper understanding of the Indian in the picture of a little Navajo boy with his burro... a sign of prosperous peace in the sleek horses grazing in a lush pasture... a deep sadness in an old prospector returning to find his "home" a ghost town. All of the West is here, its action and repose, its hope and despair, and its people's continuing sense of closeness to the land and the elements.

A few of the paintings...

When Wagon Trails Were Dim, by Charles M. Russell

The Female of the Species, by William R. Leigh

Saddled for the First Time, by Gray Bartlett
Holding Up the Payroll, by Frederic Remington

The Wise Men, by Maynard Dixon

Desert Thunderhead, by Gerard Curtis Delano
After the Shower, by James E. Swinnerton
Spring, by Ray Strang

Anyone who knows our great American West, or wants to know it, will value GALLERY OF WESTERN PAINTINGS both as an art treasure and as a pictorial history. Send for your own and your gift copies today.

American Nature Association
WASHINGTON 6, D. C.

Mention NATURE MAGAZINE when answering advertisements

NATURE MAGAZINE

PUBLISHED BY THE AMERICAN NATURE ASSOCIATION
To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and
Devoted to the Practical Conservation of the Great Natural Resources of America

IN THIS ISSUE

January, 1952

Vol. 45, No. 1

Nature in Print.....	Howard Zahniser	2
The Lesser Things (Poem).....	May Burnett	2
A Mammoth Tooth from Alaska.....	Victor B. Scheffer	6
Queen Iris (Poem).....	Ray Romine	6
Contents Noted.....	R.W.W.	7
Old Boomer from Down Under.....	Alan Devoe	9
Sleeping in the Barn (Poem).....	Daniel Smythe	12
Plutonian Power Plant.....	Blair Chamberlin	13
Sharks Have A Bad Reputation.....	Gertrude Marburger	17
The Bluejay (Poem).....	Arthur J. Wadsworth	20
Nature's Champion Globe-Trotter.....	Ida B. Alseth	21
Hares that Live in Water.....	Myron R. Kirsch	24
Dogs.....	E. Laurence Palmer	25
Cattails.....	Haydn S. Pearson	33
Our Highways and Wildlife.....	Paul Shepard, Jr.	34
The Swans (Poem).....	Allen E. Woodall	37
Bird Haven Now.....	Lela Campbell Dowell	38
The Double Life of the Fern.....	Hugh Spencer	40
In Memoriam (Poem).....	Elinor Henry Brown	43
The Heavens in 1952.....	Isabel M. Lewis	44
Stars in a Well (Poem).....	Daniel Smythe	45
The School Page.....	E. Laurence Palmer	46
Camera Trails.....	Edna Hoffman Evans	48
Under the Microscope.....	Julian D. Corrington	54

A. B. McClanahan, Advertising Manager

ADVERTISING OFFICES

New York 17-295 Madison Ave. Los Angeles 5-2978 Wilshire Blvd.
Washington 6-1214 16th St., N. W. San Francisco 4-Mills Building
Chicago 1-35 E. Wacker Dr. Minneapolis 2-1019 Northwestern
Bank Bldg.

NATURE MAGAZINE is published monthly, October to May,
inclusive, bimonthly, June to September, inclusive, by the American
Nature Association. Entered as second-class matter May 31, 1927,
at the post office at Washington, D. C., U. S. A., and accepted for
mailing purposes at the special flat rate of postage provided for in
the United States Postal Act of October 3, 1917, and February 28,
1925. \$4 a year; foreign, \$5.00. Additional entry Easton, Pa.

Publication and Editorial Office, 1214 16th Street, N. W., Washington
6, D. C. Additional office of publication, Easton, Pa.

Copyright, 1951 by American Nature Association, Title Registered
U. S. Patent Office. Printed in the United States.

THE ASSOCIATION

RICHARD W. WESTWOOD.....	President
Washington, D. C.	
HARRY E. RADCLIFFE.....	Vice-President
Washington, D. C.	
JAMES A. O'HEARN.....	Secretary-Treasurer
South Orange, N. J.	
DR. E. LAURENCE PALMER.....	Director, Nature Education
Cornell University, New York	
ARTHUR NEWTON PACK.....	President Emeritus
Tucson, Arizona	

THE MAGAZINE

RICHARD W. WESTWOOD.....	Editor
EDWARD A. PREBLE.....	Associate Editor
JULIAN D. CORRINGTON.....	Microscopy Editor
ISABEL M. LEWIS.....	Astronomy Editor
E. LAURENCE PALMER.....	School Editor
HOWARD ZAHNISER.....	Book Editor
EDNA HOFFMAN EVANS.....	Photography Editor
HARRY E. RADCLIFFE.....	Business Manager
WILLIAM H. CARR.....	Director,
Southwestern Museum Trailside Project	

SCIENTIFIC CONSULTING BOARD

DR. WALDO L. SCHMITT.....	Head Curator, Zoology, U. S. National Museum
DR. HARRY C. OBERHOLSER.....	Retired Ornithologist, U. S. Fish and Wildlife Service
W. L. McATEE.....	Retired Biologist, U. S. Fish and Wildlife Service
DR. PAUL BARTSCH.....	Retired Curator of Mollusks, U. S. National Museum
DR. EDGAR T. WHERRY.....	Wild Flower Preservation Society
DR. WILLIAM M. MANN.....	Director, National Zoological Park
DR. EDWARD A. CHAPIN.....	Curator of Insects, U. S. National Museum

NATURE MAGAZINE
PAST AND PRESENT,
IS INDEXED IN THE
READER'S GUIDE IN
YOUR PUBLIC LIBRARY

U. S. AND CANADA
ONE YEAR.....\$4
FOREIGN...\$1 EXTRA
TWO YEARS.....\$7
LIFE.....\$100

Ideal Gifts for Christmas and for all occasions

TREAT YOURSELF AND YOUR FRIENDS
TO THESE EXCLUSIVE DOLLAR GIFTS

The various items listed are excellent for personal use and for gift purposes. Beautifully reproduced in full color on high grade paper stock, they show quality throughout. The subjects were painted by famous artists — the GAME BIRD FAMILIES and WILD BIRDS by Francis Lee Jacques; the AUDUBON PRINTS by John James Audubon; the FLOWERS by Kathleen Cassell; SONG-BIRD FAMILIES and the BUTTERFLIES, MOTHS and FLOWERS by Roger Tory Peterson.



Postal Cards

You can accomplish two valuable objectives in the purchase of these gift items. First, you get items designed for people of taste and discrimination at low cost. Secondly, you help finance the important conservation education activities of the Association because the small profit that would otherwise go to a retail store will be used for that purpose.

Take Your Pick of these DOLLAR GIFTS

CORRESPONDENCE NOTE PAPER. These items packed 20 notes and 20 matching envelopes in an attractive gift box.

Song Bird Notes
Game Bird Notes
Wild Bird Notes

Audubon Bird Notes
Wild Flower Notes
Butterfly Notes

POSTAL CARDS. Packed 32 cards to a box, illustrated on extra heavy fine quality stock.

Song Bird Post Cards
Game Bird Post Cards
Wild Bird Post Cards

Audubon Bird Post Cards
Wild Flower Post Cards
Butterfly Post Cards

LARGE PRINT SETS. Each print set contains six prints size 8 1/2 x 11. The subjects are carefully selected. They are ideal for framing, for mounting on wastebaskets, telephone book covers, etc.

Song Bird Prints
Game Bird Prints
Wild Bird Prints

Audubon Bird Prints
Wild Flower Prints
Butterfly Prints

CHRISTMAS CARD AND GIFT CALENDARS. Both calendars have a Christmas greeting page, a cover page, and twelve monthly pages, illustrated in full color. The calendars are bound with cord and packed six to a box with matching envelopes.

Song Bird Christmas Card-Calendar
Butterfly Christmas Card-Calendar

1952 DAILY REMINDER CALENDAR: Size 4 x 6 featuring 14 full color illustrations from the new Song Bird Family series by Roger Tory Peterson. Ninety-six pages providing ample space for daily notes, memoranda, telephone numbers and addresses. Complete with place marker. **\$1.00 Each**



Large Print Sets

BIRD-O-GAME

Interesting and educational for both children and adults. Provides hours of fun by learning to identify our feathered friends. Contains six playing boards, markers and calling cards. Can be played by any number from 1 to 6 players. **\$1.00 Each**

Order Early to Avoid Delay

If you do not wish to mutilate your copy of the magazine and write separately, be sure to describe items desired.



Correspondence Notes

American Nature Association
1214 16th St., N.W.
Washington 6, D. C.

Enclosed is \$_____ for _____ items as indicated, at \$1.00 each.

(Be sure to show the number of boxes of each item desired)

- ☐ Song Bird Notes
- ☐ Game Bird Notes
- ☐ Wild Bird Notes
- ☐ Audubon Bird Notes
- ☐ Butterfly Notes
- ☐ Flower Notes
- ☐ Song Bird Post Cards
- ☐ Game Bird Post Cards
- ☐ Wild Bird Post Cards
- ☐ Audubon Bird Post Cards
- ☐ Flower Post Cards
- ☐ Butterfly Post Cards
- ☐ Song Bird Prints
- ☐ Game Bird Prints
- ☐ Wild Bird Prints
- ☐ Audubon Bird Prints
- ☐ Flower Prints
- ☐ Butterfly Prints
- ☐ Song Bird Christmas Card-Calendar
- ☐ Butterfly Christmas Card-Calendar
- ☐ 1952 Daily Reminder Calendar
- ☐ Bird-O-Game

NAME.....
Street and No.....
City.....Zone....State.....

A Mammoth Tooth from Alaska

By VICTOR B. SCHEFFER

I WAS beachcombing on the island of St. Paul, Alaska, in the wake of a storm. A heavy surf had pounded the shoreline for several days, leaving behind it great windrows of seaweed, driftwood, and debris. I found bits of walrus ivory, green glass net-floats from the Orient, a mahogany plank, a copper tank from a wrecked boat, and many bodies of sea birds and fur seals.

My companion was Xenophon Hanson, a native of St. Paul who speaks the Aleut tongue as well as English. He was born on the island and now works for the Government as an electrician. He suddenly stooped and picked up a strange object, which he is shown holding in the accompanying illustration. Brushing off the sand he brought it to me, turning it over curiously in his hands. One glance revealed that it was a cheek tooth of the mammoth, a relative of the elephant, gone from the face of the earth for 10,000 years. Not since the 1890's had mammoth remains been found on St. Paul Island. We took the tooth to the village and found that it measured nine and one-quarter inches in length and weighed three pounds, eleven ounces. It seemed to be partially fossilized, although it was not embedded in a stony matrix.

How did it find its way to St. Paul across two hundred miles of water? No doubt it came from the mainland of Alaska, where it fell from a stream bank or sea cliff upon a block of ice. Later it was rafted slowly southward and westward, eventually coming to rest on the tidal beach of St. Paul. The Arctic drift ice generally comes as far south each winter as the Pribilof Islands, of which St. Paul is a member. Again, the tooth may have fallen from an ice floe into the shallow Bering Sea and have been carried to the island by kelp. The great brown seaweeds of the North Pacific, some of them a hundred feet long, anchor themselves by means of root-like "hold-fasts" to stones on the floor of the sea. If the stones are small enough to be moved, winds may blow the kelp, anchor and all, to land.

There is another possibility. At a time when a thick



ice sheet, or, less likely, a land bridge, connected the island with the mainland, the shaggy owner of the tooth may have brought it in person to St. Paul.

Alfred M. Bailey and Russell W. Hendee, of the Colorado Museum, wrote in 1926 that "mammoth remains are met with by the collector throughout the Arctic. We occasionally picked up bits of 'elephant ivory' along the beach and the Eskimos were continually bringing in pieces of ivory and occasionally teeth which they had picked up along the beach or the tundra."

Since 1836, discoveries of mammoth remains on the Pribilof Islands have been reported five times. The most recent find before Hanson's was one made by Dr. R. E. Snodgrass in 1897 in a volcanic cave on St. Paul. Since this is a most unlikely place for mammoth teeth to show up, some naturalists have suspected that another member of the party played a trick on him and "planted" the tooth in advance. While scientists are not above such tricks it is hard to believe that anyone would deliberately allow a deception of this kind to go unrevealed for any length of time.

★

Queen Iris

By RAY ROMINE

She holds her stately head erect
And lets attendant bees
Carry off her dust of gold
To other families.

Her pride flares fiercely. None must know
Of her unmoneyed plight:
Of how those dew-rinsed velvet robes
Were borrowed from the night.

Contents Noted

HOPE is still very much alive that Island Beach, the only remaining unspoiled bit of the New Jersey coast, may yet be preserved and given permanent protection under the National Park Service. We have previously reported on this area (October, 1950) and urged its preservation as unique. We are happy to report that a special exhibition on Island Beach has been prepared and is on display at the New Jersey State Museum, Trenton, New Jersey. It will be there through January. This exhibit covers both the past and present. For example, an old map, dated 1778 and loaned by Rutgers University Library, shows that what is now a peninsula ten and one-half miles long was once an island. Bird life on this stretch of beach is remarkable for its numbers and diversity, and the exhibition includes photographs of the bird life loaned by the National Audubon Society. The vegetation on the area is distinctive, also, and the exhibit includes specimens of this, as well. This display is a distinct contribution to public knowledge of a bit of relatively primitive America that, somehow, should be permitted to remain primitive.

ACCORDING to an Associated Press dispatch from Paris, our Ambassador, David K. Bruce, took part in a diplomatic shoot at the summer estate, at Rambouillet, of Vincent Auriol, President of France. The brief item reports that Mr. Bruce "knocked down" 70 pheasants, while M. Auriol managed to get only 41. Of course M. Auriol's estate was stocked with these birds for which, it is presumed, the French President paid, so it is probably nobody's business how many birds any diplomat "knocked down." Nevertheless, we cannot help but feel that publicity about such a considerable day's bag, which must have been obtained with all the sporting challenge of a tame turkey shoot, is unfortunate. Through such agencies as the International Union for the Protection of Nature, attempt is being made to further appreciation and wise management of wildlife resources, among other natural resources. And the United States is wont to hold itself up as a nation meeting the problems of such management with special wisdom. Mr. Bruce's bag of three score and ten pheasants, even on a private preserve, does not seem to sit well in the light of this, however much the embassy staff may have enjoyed pheasant dinners.

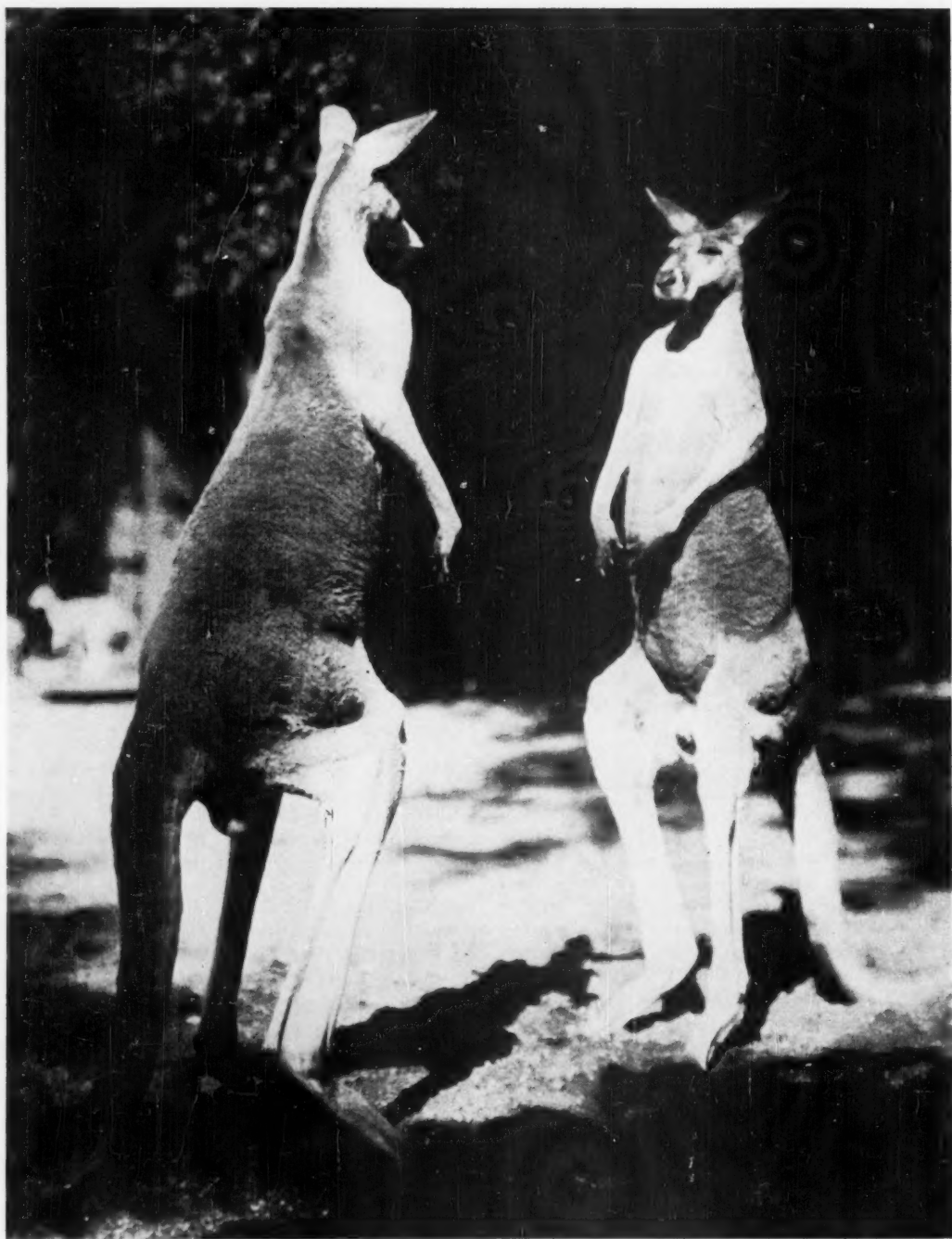
FOR some years the Entrance Highway, State 64, to Grand Canyon National Park has been plagued by the staking out of mining claims along the highway. This highway passes through Kaibab National Forest, but forest authorities were unable to prevent such claims. It was known that most of these claims had the real goal of getting an area on which filling stations, hot dog stands, or billboards could be erected. There

are already too many such nondescript enterprises along the route. With the help of Grand Canyon National Park officials, a bill was introduced in Congress by Representative Patton of Arizona requiring that only legitimate claims based on real mineral showings could be filed. This legislation is now law and a conservation victory.

FROM Korea comes a Nature report by Pfc. Fred Fisk, who writes of the pleasure he gets from reading *Nature Magazine* out there. He says that, lacking any identification books, he has difficulty trying to place birds and flowers in any scientific category, but that they are there in variety. He is amazed to discover that, despite shelling and bombing, mountains seem to maintain their supply of wildlife. Private Fisk reports many ravens "more graceful in flight than our American crows," a variety of ducks, a type of jay, large woodpeckers, swallows, pheasants and geese. There are many wild flowers, he writes, and ladyslippers grow by the thousands along the creeks in many Korean valleys. He feels that butterflies and other insects are brighter in color than those at home. Private Fisk, who hails from Linton, Indiana, closes his interesting letter by saying that, although baffled as to species, "Nature has given me something to look at over here while fighting a bloody war. It kind of makes time go faster and brings God closer."

THAT recent news story from Illinois about the farmer who set up a stuffed pheasant in his field and retired to his house to observe results is discouraging. In all, two hundred gunners stopped, got their guns out of their cars and blazed away. Only two asked permission to shoot. They broke Illinois laws against carrying loaded guns in cars, shooting from the highway and trespassing. And they broke the unwritten law of all decent sportsmen by shooting at a sitting bird. Something must be radically wrong with the educational programs of organizations of sportsmen and of the State game departments. Unfortunately such incidents as this in Illinois are repeated, in one form or another, in many parts of the country during the shooting season. We still think a gunner should have to pass an examination before getting a license.

SHOULD anything take you to the vicinity of Houston, Texas, you will find it worth while to get acquainted with The Little Thicket Nature Sanctuary maintained by the Outdoor Nature Club of Houston. This is a 450-acre area that includes picturesque hills and ravines, open fields, thickets, and park-like glades. Four brooks fed by numerous springs are on the property. The sanctuary is on the headwaters of the San Jacinto River and on paved Farm Road 945, near Evergreen in San Jacinto County. Joe M. Heiser, Jr., 1724 Kipling Street, Houston 6, is director of sanctuaries for the club, and will be glad to send a little folder about Little Thicket if you provide him a stamp. —R.W.W.



Kangaroos love to box but rarely lose their tempers when indulging in fisticuffs. Observers have been astonished to see how scrupulously the animals observe the rhythm of rounds and rests even though this pugilistic play is of long duration.



AUSTRALIAN OFFICIAL PHOTOGRAPH

The huge hind legs of the kangaroo have steel-spring power and can send the animal sailing over a ten-foot fence with ease. Here a group takes off across a field in New South Wales.

Old Boomer from Down Under

By ALAN DEVOE

In 1770 the famous explorer Captain James Cook sent a party of his men ashore from his ship, the *Endeavor*, to scout for food in the unknown Australian bush. They came back goggle-eyed, bringing with them an animal that resembled nothing ever before seen on land or sea. The beast stood a good five feet high, with a thick, heavy tail adding another four feet to its length. It had a delicately shaped head and neck like a small deer's, but these graceful upper parts sloped down to huge, heavily muscled hind parts like the rear sections of an overdeveloped mule. The animal had a twinkly little nose and lips like a rabbit's, hands like a man's, hind legs at least three sizes too long, and on the underside of its stomach, for a final impossibility, it had a capacious fur-lined pocket.

What could this fabulous crea-



PHOTOGRAPH BY HOMER F. SNOW

The great gray kangaroo starts life as a baby so small two or three can lie in a teaspoon.

ture be? When Captain Cook's mariners first questioned the natives about it, they spread their hands eloquently, shrugged their dusky shoulders, and murmured "Kangaroo!" Freely translated, that means: "It would be hopeless to try to tell you!"

It took the zoologists of Europe years to decide where to place the kangaroo. For quite a while they seriously debated whether it might not be a species of nightmare-sized mouse. Finally they put it down as the chief of a strange zoological order called the marsupials — *mar-supium* is Latin for pouch. The kangaroo is found nowhere in the world but in Australasia. Ages ago, when that part of our earth became cut off from the Asian mainland, there was also cut off and isolated, as in an ideal natural preserve, this weird animal from Nature's long-ago.



Young "Joey," as the Australians call the young kangaroo, peeks from its mother's pouch, quite content to leave problems to her.

AUSTRALIAN OFFICIAL PHOTOGRAPH

the attack of a dozen dogs. A twitch of his tail can break a man's leg like a matchstick. But this grand old Boomer, king of the plains, starts life as a baby so tiny that two or three of them could lie in a teaspoon.

A newborn kangaroo is less than an inch long — about the size of a bee. Pink, blind, helpless, it is such a fragile and incompletely formed little mite that its body is actually semi-transparent, like an earthworm's. The only part of the baby that is fully developed is its little "hands." Just as soon as tiny Joey is ushered into life, he grips his mother's fur with all his might and, guided by instinct, starts hitching his way toward the protective pouch on her abdomen. Ordinarily little Joey makes the trip entirely on his own. On the rare occasions when he needs help, his mother takes him gently in her lips and tucks him away in the pouch. The pouch is all Joey's, for there's only one baby kangaroo in a birth.

As soon as Joey is installed in the pouch, he takes hold of a milk gland and hangs on with an inseparable grip. So firmly does he attach himself, and so virtually impossible is it to pry loose a baby kangaroo from his nursing, that there is widespread belief in the Australian back country that Joeys are somehow born

from their mothers' milk glands. Joey is not strong enough to feed himself by sucking. Instead, Nature provides the mother kangaroo with special muscles by which she pumps milk into him.

How on earth can little Joey breathe with milk continually being pumped into his gullet? It took naturalists years to find the answer to that one. While Joey is a nursling infant he has a specially adapted breathing apparatus. An elongated upper part of his larynx projects into direct connection with the back part of his nasal passages, so that air can pass directly into his lungs without involving mouth and gullet at all. He can keep up his milk-drinking all the while, and never choke.

By the time he is four months old, Joey has grown a coat of fur, detached himself from his mother's milk supply, and now has taken to pecking up out of the pouch in the pose dear to cartoonists. When his mother halts to graze, he clambers out, hops to the ground, and does some grass-nibbling on his own. But at any sign of danger he scampers back into the pouch and is whisked away on a bouncing flight to safety. If a mother kangaroo is run down and captured, exploration of her pouch almost always disappoints the eager captors. There is never a little Joey to be found. A mother kangaroo's favorite strategy when she is being

There are about two dozen species of kangaroos distributed throughout Australia, southward to Tasmania and northward to New Guinea and some neighboring islands. They are known by a variety of picturesque names: wallabies, wallaroos, potoroos, boongaries and paddy-melons. Some are no bigger than rabbits. Some can climb trees. But the kangaroo — the one that is Australia's national symbol, and admirably known throughout the island continent as The Old Man — is the great gray kangaroo of the plains. With its close relative, the red or woolly kangaroo, it represents kangaroeness in its full fantasticality. This is The Old Man, also respectfully saluted by the titles Boomer, Forester, and Man of the Woods. His smaller mate, in Australian talk, is a "flyer." Their baby, whose birth and upbringing make one of the most amazing chapters in kangaroo life, is known, with much affection, as Joey.

A full-grown kangaroo stands taller than a man, and commonly weighs 200 pounds. Even when he sits down in his favorite position of rest, reposing on his massive haunches and tilting back on the propping support of his "third leg" — his tail — the tip of his nose is five feet or more above ground. His huge hind legs, with steel-spring power, can send him sailing over a ten-foot fence with ease, or in a fight can beat off

There are some two dozen species of kangaroos in Australasia, including the rock wallabies found in the rocky ranges and among rocky outcrops on the mainland.

AUSTRALIAN OFFICIAL PHOTOGRAPH

chased is to lift her baby out of her pocket and hide him somewhere in the shrubbery. When she has tired out her pursuers by mile after mile of springing bounds, she quietly comes back and retrieves Joey.

Grown to adulthood, Joey becomes a member of a group. Kangaroos are gregarious animals, and live in bands sometimes as large as twenty or even fifty. They are entirely vegetarian and do most of their browsing in the early morning, at dusk, or by moonlight; in the sunny mid-days they give themselves over to resting and play. Their favorite and most famous sport is boxing.

A big Boomer's five-fingered hands are very much like a man's, and the kangaroo loves to use them exactly the way a boy instinctively uses his when he is first learning to "put up his dukes." When two kangaroos square off, each holds his hands close to his chest in a tight guard, steadies his body with his heavy tail, and then begins flicking and feinting. Presently there is a flurry of brisk clouts, and then the two boxing Boomers dutifully step back and pause for the end of Round One. The kangaroos rarely lose their tempers, and naturalists have been astonished to see how scrupulously they observe a rhythm of rounds and rests, even when their pugilistic play goes on for hours. They are not fighting to win, but just for the sport of it. Anyone who has seen kangaroos in sparring exhibitions with a human partner probably has supposed that the animal had had to undergo a long period of training. Actually, kangaroos take to boxing as naturally as they take to the arts of high jump and broad jump. The chief problem is to teach a kangaroo not to use its terrible hind-leg kick — a technique that should be used only in the fight to kill. Like everything else about a kangaroo, its kick is unexpected.

On a kangaroo's hind foot there are four toes, but Nature has modified three of them to such trivial size that they do not count. Instead, one toe has been made tremendously long and strong, like a huge spur with a curving, razor-sharp tip. A kangaroo is a gentle vegetarian, its big soft eyes as mild as a deer's, its spirit as inoffensive as a rabbit's. But when the Old Man is cornered and his life is at stake, he can turn into a most murderously dangerous animal. He does not do any boxing now. He rears up, braces himself with his



third-leg tail, clenches his fists close to his chest and then suddenly kicks out in a slashing blow with one of his spurred hind legs. One kick can easily kill a powerful dog or a man. A fighting 'roo, with his cleft lip drawn back from bared teeth and his mighty hind legs pumping in and out like sharp-pointed pistons, is one of the most awesomely savage spectacles in Nature.

A Boomer usually does not resort to this last-ditch kind of defense. He can get away from pretty nearly anything else on legs, and it is flight that he prefers. A kangaroo in a hurry makes nothing of a soaring broad-jump of thirty feet, and he can lope along for miles in continuous gliding bounds of fifteen or twenty feet. He has been known to zoom over a twelve-foot stock fence, and to hit close to fifty miles an hour in straight-aways.

Englishmen being Englishmen, the early Australian settlers of course had a go at hunting the kangaroo with foxhounds. They soon found that Boomer's pace and staying power are something unique in the world, and that foxhounds are hopelessly inadequate. Over the years they have developed specially bred, rough-haired greyhounds to produce a strain of "kangaroo dogs" — one of the few things on four legs that stand a chance of running down old Boomer. A kangaroo chase may take from sunrise to nightfall, cover more than twenty miles of hard going, and wind up, at last, with a dog-drowning.

For the Old Man, unless he is hopelessly cornered by the pack, does not stage a hind-leg defense. He just bounds into a shallow watercourse, wades out until he is waist deep, and then turns and waits. As the dogs come threshing out to him, he reaches out with his nimble hands, grabs his foes and pushes their heads under water, and holds them there. A strong old kangaroo, at bay in the water, has been known to drown

half a dozen attacking dogs, one by one.

For all his impressive fighting power, a Boomer is reluctant about using it. Kangaroos love nothing better than just to sit by the hour in the tall, sun-bleached grass, like so many rabbits in a meadow, dozing and nibbling and twinkling their noses. Like king-sized rabbits, too, they play a game of bounding rigmaroles that resembles tag. A Boomer's idea of a happy evening, as the Australian moon spreads its silver magic across the grasslands, is to browse at peace with his gathered fellows and every now and then liven up the proceedings with a friendly round of fisticuffs.

Kangaroos have meant many things to Australia. They were a chief food supply for the original natives — who brought down old Boomer, of course, with a boomerang — and they were equally important in furnishing food to the early colonists. Kangaroo meat is gamey and coarse, but certain selected portions of it are delicacies. Kangaroo loin has graced many a back-country table, and kangaroo-tail soup is held to be better than ox-tail. Australia exports it to gourmets all over the



PHOTOGRAPH BY ARTHUR H. FISHER

The great gray kangaroo is affectionately called *The Old Man*, and also *Boomer*, *Forester* and *Man of the Woods*.

still be facts, or at least gain acceptance as facts. For there is nothing else like him in all zoology.

world. One dish of Australia is a preparation of steamed kangaroo cooked with bacon.

Today the kangaroo is a rare sight along Australia's heavily settled east coast. They have been driven by civilization to the vast plains of the "Outback" where they live and breed in great numbers. In drought years they are a menace to grazing lands and water supplies and, after a local rainfall, may attack a farmer's pasture in greedy hordes. One sheepman recently counted 2000 'roos in one hour — each one capable of eating more than a sheep.

Kangaroo shooting is a lively business in some districts of Australia; the skin makes excellent glove and boot leather and the fur is a valuable export. More than a million skins a year are brought to market.

Kangaroos also provide an endless supply of tall tales to which wide-eyed visitors are treated in the land Down Under. The beauty of tall tales about the kangaroo is that they can be almost as tall as you please and

Sleeping in the Barn

By DANIEL SMYTHE

Between dark mows we know are near,
We feel that summer's breath is here —
The smell of hay that once has stood
Upon a meadow's solitude.
The tall doors that we opened, hold
A strip of sky wherein are told
The stories of the wheeling stars
Across the summit's pasture bars.
Above the haymows on a wall,
The moonlight makes a silvery scrawl
Of stars and glitter — webs and beams
By which we trace its distant seams.
The barn has noises, slow and dim.
Across the dark the frail bats skim,
And as we fall to sleep we think
Of night that finally will sink,
And the great doors that will be changed
When dawn's new opening is arranged —
And how that strip of sky will show
Its blueness to us as we go.

Plutonian Power Plant

By BLAIR CHAMBERLIN

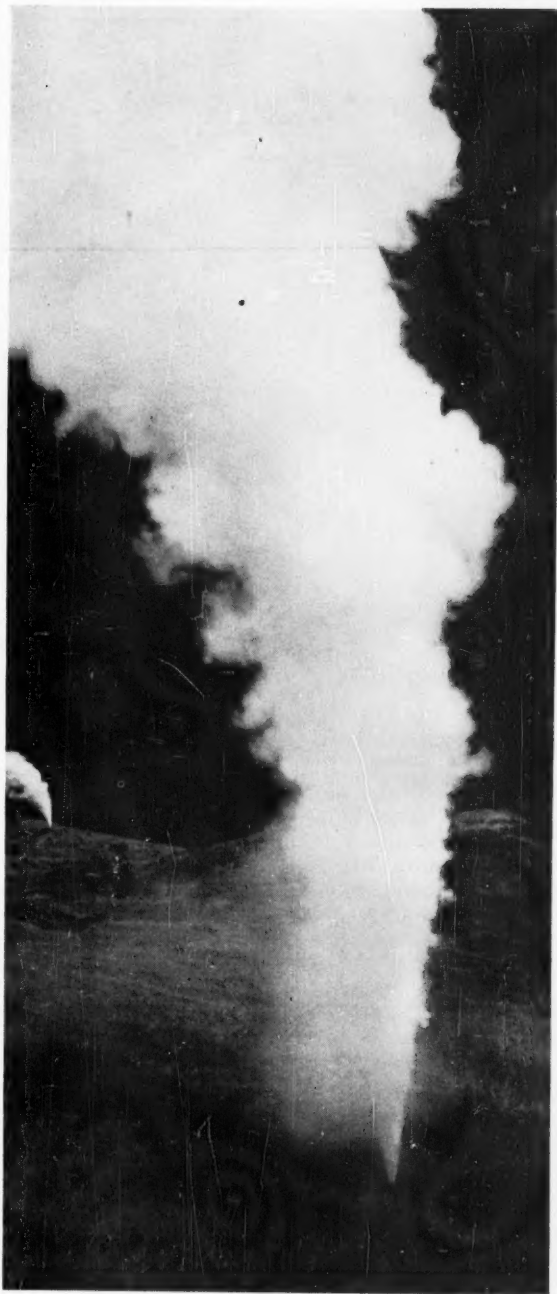
TUCKED away in an obscure canyon of the St. Helena Range, a hundred miles north of San Francisco, is one of the most unusual "hot-spots" in all of North America.

From the mountainside shoot tall columns of intensely hot steam. The enormous white plumes, a hundred feet and more in height, writhe and roar with a blast so deafening that they can be heard for several miles. Canyon walls, wreathed in vapor clouds and streaked with weird colors, loom above belching, boiling hot springs that gurgle and gasp like a giant clearing his throat. Thrust up from the core of the continent, strange chemicals, minerals and odorous gases seep and filter from every crevice and fissure in the rocky crust. Even the earth itself quakes and rumbles with subterranean heat and pent-up power.

It is true that hot springs, fumaroles, steam vents and geysers are found in many places throughout the world. But these simmering acres do not lay claim to fame on that score alone. This small, little-known thermal area deserves distinction because it is the only place in the entire western hemisphere where men have successfully harnessed the terrific energy of terrestrial heat. At only one other point on the globe has man so far realized his long-harbored hope of putting to work at least a tiny portion of this tremendous reservoir of natural power — power, in the form of high temperature steam and other vapors, that has been escaping from the earth's volcanic regions ever since our world began.

Men who make a study of such things believe that beneath the rocky backbone of the Coast mountains in this particular region there exists a seething broth of viscous, molten magma; probably formed by a combination of pressure, chemical action and radioactivity. Filled with hot gases and magmatic materials under pressure, this enormous subterranean blister is what geologists refer to as a *laccolith*. Although the earth's crust must here be thin, it still is apparently tough enough to prevent the blister from popping open to form a volcano. Like a gigantic safety-valve the rocky crust has stretched and cracked sufficiently to allow the imprisoned vapors to escape, thereby reducing their tremendous pressure below the danger point.

Even though the source of this magmatic heat may be accounted for, it is still amazing to find



The spectacular steam jets from which The Geysers get their name. They display their greatest activity in the early morning and late evening when their white plumes tower 300 feet and more in the still air.



Although constantly subjected to the corrosive action of gaseous vapors for 25 years, the metal valves and piping of these wells are still intact.

such a wide variety of thermal activity concentrated in this small an area. Although the entire hot springs region is scattered over about six hundred acres, the major activity is confined to only about sixty. Crowded into this limited locality are eight steam wells, more than thirty-five individual hot springs, several steam-vapor caves and an uncounted number of steam vents and fumaroles. As a result, there is nothing static about any part of this seething, satanical scene. Like

a gigantic kettle of Vulcan's brew suspended over a bed of red-hot coals, the over-all impression is one of unceasing, constant action; the turbulent outpouring of heat in all its various forms from deep within our planet.

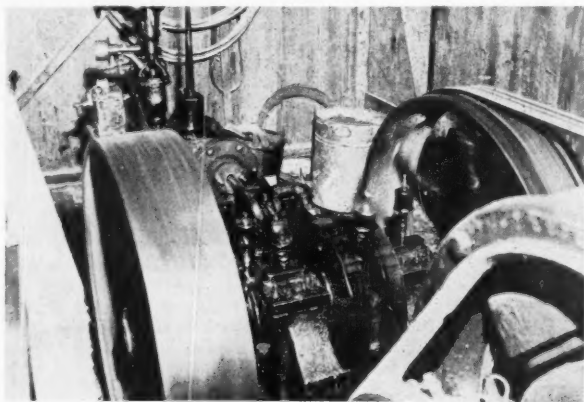
Clouds of vapor seep from cracks and fissures to hover above the canyon walls. Steaming hot, many-hued waters trickle and cascade down the rocks, staining them with myriad colors. Boiling springs bubble and simmer, belch and erupt in miniature showers of hot spray. While over and above all else the lofty, white, steam jets, balanced on their invisible bases, scream with escaping, awesome power.

These loud-voiced columns of steam might almost be called "trademarks," for this once-famous but now obscure hot springs area has been known for almost a century as The Geysers — a spectacular but erroneous name, for there actually is not a true geyser in the locality. Strictly speaking, although the word "geyser" originated from an Icelandic word meaning "to gush forth with violence," the term is now applied only to actively boiling springs, which, at intervals, throw out columns of hot water and steam.

In reality the so-called "geysers" of this region are man-made steam wells, drilled for the purpose of tapping the tremendous store of live steam that underlies this fascinating area. Aside from old-time residents and a handful of volcanists and engineers, comparatively few persons know the story of the unique steam wells at The Geysers. The actual drilling process was probably one of the most unusual projects in the annals of engineering, for the drillers in this case were probing not for water or oil but for live, natural steam.

From his very first visit to The Geysers, J. D. Grant of nearby Healdsburg, was impressed with the tremendous amount of high temperature steam that was constantly escaping from the cracks and fissures of this unusual spot. With a well-drillers know-how and experience, Grant was certain that beneath his feet there existed a limitless, untapped source of cheap power, waiting for someone to come and get it.

Unaware that such an unusual engineering feat had already been successfully undertaken in Italy, Grant set up his drill-rig and started boring his first experimental well in the summer of 1921. The drill had penetrated only to a shallow depth when this first well proved beyond a doubt that Grant's theory was a fact. It developed so much pressure that the heavy steel casing was blown out of the hole, wrecking a part of the equipment. This hole was then abandoned, but the following summer the well now designated as Number One was begun in an area that was liberally dotted with active steam vents.



The only steam engine in America that is driven by volcanic steam.

In the course of drilling this first permanent well the drill encountered soft material, composed largely of decomposed rock for the first eighty feet, and it was soon apparent that the steam flow increased rapidly with depth. At eighty feet a sandstone cap or ledge was struck, but drilling continued until a depth of 203 feet was reached.

In order to control the flow of steam during the drilling process, a stream of cold water was admitted to the bore-hole and thus condensed the rising vapors. At half-hour intervals the drill was removed and the well was allowed to "blow" until it had discharged the accumulated water and debris. After the drill had penetrated the sandstone cap, a steel casing eight inches in diameter was lowered into the hole and anchored by pouring molten zinc around it. After reaching sufficient depth the well was closed off by a heavy valve screwed to the top of the steel casing. When a steam gauge was attached to the outlet pipe it showed the surprising pressure of sixty-two pounds to the square inch.

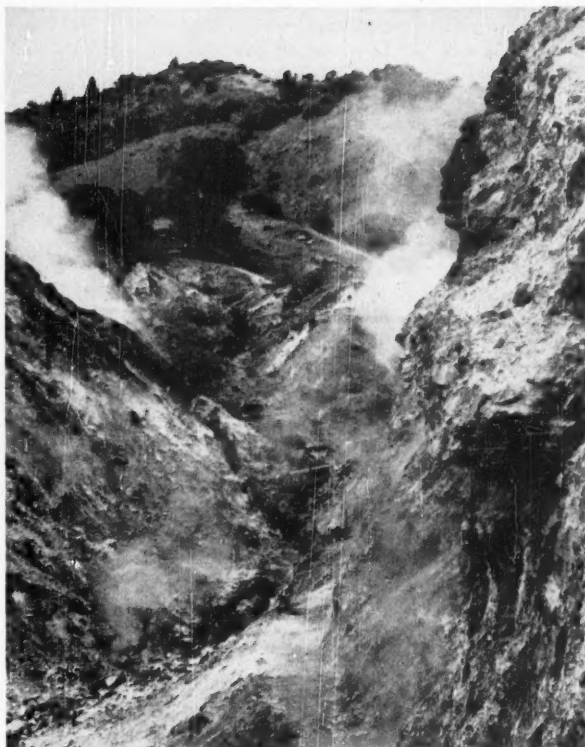
From then on no more fuel was required by the well-drillers, for old Mother Earth furnished the power, gratis. The steam from well Number One was employed to drill Number Two, which was started within about fifty feet. This second well was drilled to a depth of 318 feet, and, when completed, showed a steam pressure of sixty-one pounds to the square inch.

Eight wells in all were attempted and six were completed over a period of about four years. Profiting by the experience gained on the first few wells, improved methods and equipment were used to drill the last four. Diamond-point drills with hollow stems were used, and this permitted a flow of cold water through the drill stem at pressures up to 250 pounds. This was found to be more efficient in condensing the steam during the drilling operation.

Once the drill had penetrated the layer of soft material near the surface and reached the solid rock cap, a ten-inch wrought-steel casing was put down and concrete was poured around it to hold it in place. When the hole had reached sufficient depth an eight-inch casing was lowered inside the larger one and this space was also filled with concrete.

When the cold water went down, the drill stem returned to the surface at close to the boiling point, it was found that this indicated the desired depth for steam pressure and temperature had been reached. The drill was then removed, all openings closed and the debris was blown out by the pressure that had built up inside the casing.

The "blowing-in" of each steam well was as spectacular as a gusher in an oil field. When the large valve that capped the well was opened, a gigantic column of hot water under great pressure erupted violently. With



Geyser Canyon where boiling springs and steam jets fill the air with hot vapors and streak the walls with startling colors.

a tremendous roar it rose in great leaps, carrying with it a mixture of rock and sand that bombarded the steel derrick with a sound like machine-gun fire. The leaping column quickly reached its maximum height of two to three hundred feet, cleared itself of debris, then changed to an intensely hot, roaring blast of steam. This magmatic steam and gas was found to be superheated from 15 to 25 degrees when it came out of the ground. Such superheated steam contains less moisture, more heat, and consequently more power and greater efficiency than steam at normal temperature.

Once the drilling project was completed all the main wells were subjected to a series of exhaustive tests and experiments. Engineers, volcanists and other scientists who observed the wells in action and studied the reports of the tests were baffled by some of the puzzling facts that were revealed. Many of the questions still remain unanswered riddles.

Although the wells varied in depth from 150 to 600 feet, steam pressure, flow and temperature did not vary uniformly with depth. Pressures ranged from sixty pounds to one hundred seventy pounds, while temperatures of the steam varied from 200 to 350 degrees Fahrenheit, the flow of steam ranged from seventy-five

thousand to forty thousand pounds per hour.

After a well had been opened and allowed to discharge constantly for months, then closed again, the pressure rose rapidly to its original value. Although two wells might be but a short distance apart, the pressure of one had no effect whatever on the other. Discharge of all the wells at the same time failed to have any visible effect on the nearby natural steam vents. Even in spots where the ground surface indicated no abnormal temperature, drilling disclosed an underground store of steam.

The original plans of the unique power project called for all wells to discharge into a single large pipe or "header." Once all the tests were completed engineers estimated that the power developed from the four main wells alone would exceed six thousand horsepower. This energy, when used to drive turbo-generators, would produce close to five thousand kilowatts of electrical power.

Development of these amazing wells came to a standstill in 1925 when legal difficulties, lack of funds and dissension among stockholders and promoters of the daring scheme caused abandonment of The Geysers project. For the past fifteen years, however, a nearby health resort has been supplied with electric power developed by a steam engine operated with live steam from one of the wells. In addition to furnishing power for the engine, the steam wells supply the resort heating system, the laundry, and aids with the cooking. A modern, more powerful turbo-generator, with parts especially designed to resist the corrosive action of the gases present in the natural, unfiltered steam, is now being installed.

It does seem strange that this supply of natural steam has never been further exploited. Nevertheless, the intriguing experiment is of importance because of the fact that an apparently inexhaustible store of steam was revealed by the drilling of the wells. After discharging continuously for almost a quarter of a century they still show no sign of diminishing pressure, no evidence of exhaustion.

Outside The Geysers area, the only other volcanic power project in the world is the one in the province of Tuscany in Italy. There natural steam from a large number of wells has been used to generate electricity for a good many years. In 1904, near Lardarello, volcanic steam was used to develop mechanical power for the first time in history when a natural steam vent was enclosed and the resulting pressure was used to drive a small steam engine. Once this initial experiment had proved that volcanic steam could be harnessed, wells were drilled. These yielded an apparently inexhaustible supply of steam with pressures as high as 200 pounds and temperatures up to 375 degrees F.

When it was found that corrosive vapors mixed with the natural steam ate away the metal of the engines, a system was devised whereby the heat was extracted by condensers and then used to raise pure water to the boiling point in a low pressure boiler. The resulting

steam was then piped to turbo-generators. A single well 400 feet in depth discharged sufficient steam to operate three turbo-generators of 2000 kilowatt capacity. In addition to utilizing the heat from the steam wells, a number of chemical by-products, chiefly boric acid, are recovered in the condensing process.

The amount of steam that escapes from volcanic areas is amazing. It has been estimated that, over a period of only about three months, a single subsidiary cone of Mt. Etna in Sicily discharged 460 million gallons of water in the form of steam. In fact, most scientists agree that all water on the earth, as well as the moisture-laden clouds above it, originated as magmatic steam spewed from volcanoes.

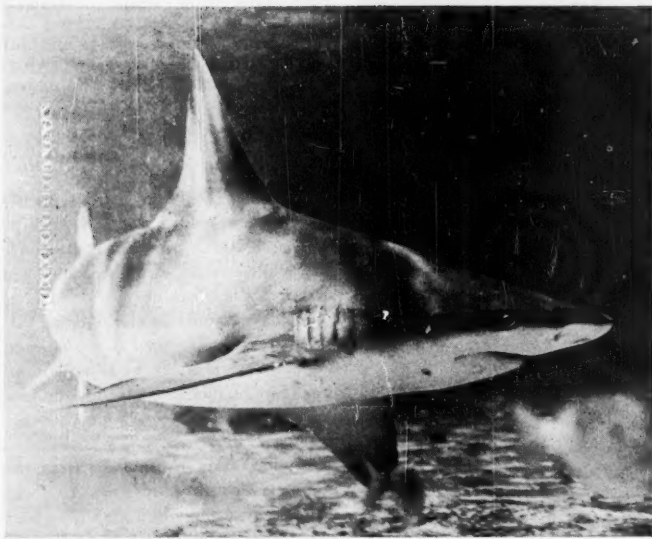
For centuries men have dreamed of utilizing volcanic heat. Many of the proposed projects have been impractical and even ludicrous. As late as 1932, a Chilean corporation advertised for some enterprising wealthy individual who might be interested in purchasing a nice, quiet volcano, guaranteed to develop several hundred thousand horsepower.

However, making use of volcanic heat does not mean harnessing the eruption of an active volcano, but rather the utilization of the heat that is generated within the earth and which comes to the surface in the form of hot vapors, steam and boiling water. For example, in Iceland where boiling springs and geysers abound, the scarcity of fuel is offset in some regions by piping water from hot springs to heat dwellings. In Reykjavik a large natural hot spring has been converted into a laundry for the use of the public. In Japan, for many years, the steam of fumaroles has been used to heat schools and other public buildings.

In some parts of the world farmers have long made use of volcanic heat in raising crops. Near Naples, on the island of Ischia, farmers use the heat from steam vents to warm tomato plants and to heat hothouses. A farmer who raises crops on the bottom of the extinct crater of Agnema irrigates his fields with water from hot springs and thus has vegetables the year around. (And some day his vegetables may go sky-high!)

Because of the marvelously fertile soil formed by disintegrated lava and volcanic ash, volcanic regions are usually excellent for agricultural purposes. Eruptions add potash, phosphates and other valuable plant foods, and the porous nature of the soil aids root growth. This accounts for the verdant vegetation found in such volcanic areas as Java and Guatemala, and helps to explain why volcanic eruptions so often occur in thickly populated areas. For centuries men farmed the fertile fields over Pompeii, unaware that their crops grew over the remains of a once-great city.

How strange it is that man has poked his inquisitive fingers into almost every nook and cranny on the earth's surface; delved into the depths of the seas; climbed the highest mountains; lifted himself up into the stratosphere, and learned to probe the universe itself with his remarkable telescopes — but what goes on beneath his feet, below (Continued on page 50)



Sharks Have A Bad Reputation

By GERTRUDE MARBURGER

A sand bar shark at the Marine Studios, Marineland, Florida, poses. Its pointed snout, typical of sharks, identifies its relationships. Five gill slits are to be seen above the pectoral, or side fins of the animal.

THERE are few who enjoy the sight of a shark, its terrifying yet graceful form appearing to ease through the waters without effort, cruising for castoffs from a ship or searching for a tired fish that can not outswim it. The shark moves in a straight line, and it is difficult to see the right-to-left motion that enables a fish to swim. If the shark must turn suddenly, the long, curved tail works harder, but the body is just as still.

This solitary wanderer has always been the mysterious and unpredictable fish. Scientists puzzled over the shark's primitive form when classifying vertebrates and invertebrates, and decided they could not call it a true fish by all rights. They finally placed it, along with a flat, bottom-living creature of the sea, the ray, in their own sub-class.

A brief inquiry into the shark's family background helps explain its primitive appearance. This "living fossil" comes from a long line of numerous and hungry sea-thieves, ranging in size from the rather small dogfish to the giant of all fishes, the whale shark. The shark has no "family life," the female shark, with few exceptions, giving birth to living young. The exception, including the older species of sharks, lay their eggs in horny cases. But — whether born alive or hatched — baby shark is strictly on its own; it must learn to be self-sufficient or perish.

Tracing the shark's ancestors is a wearing task. Fossils of shark's teeth believed to be from periods of eight to thirty-six millions of years ago prove this. If one-was-here-first serves as the sole basis for supremacy among backboned creatures of the ocean, the shark can pose with pride beneath the family tree. Its class existed before the modern bony fish, and even before any land vertebrates.

The shark's features, little changed from primitive

ages, are the sharpened shape of the head and snout, lack of scales or gill-coverings, and location of the mouth on the lower side of the head.

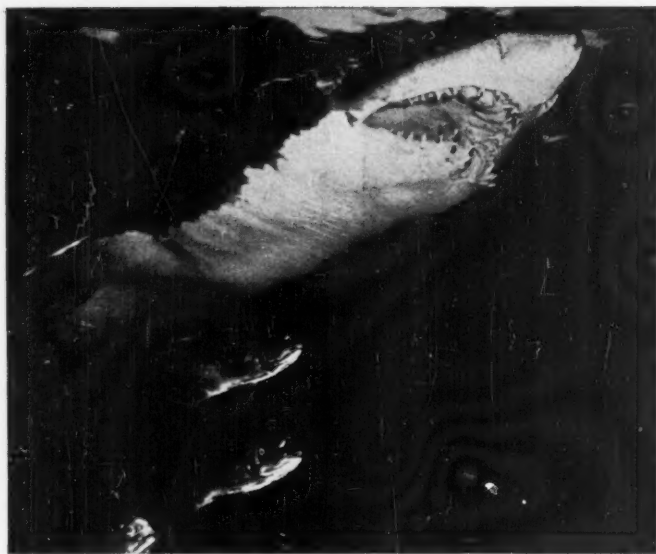
In light of the bad name carried by Jack Shark, one finds it difficult to connect this animal with the word "useful." Yet, shark liver contains vitamin A; its fins are sold as delicacies in Chinese restaurants; its hide is welcomed by leather manufacturers; its meat appears on many a table despite its toughness; its bones mean meal for the dog-food market; and its triangular teeth are sold to souvenir hunters.

The smaller species of sharks are dogfish, so-called because of their fondness for traveling in packs. But they are more often called pests. These two- or three-foot sea-food gourmets feast upon lobsters, crabs, squids and varied fishes.

The dogfish, however, has special meaning to the zoologist. Since this littlest member of the shark family is obtained, kept, and dissected easily, it is valuable in the biological laboratory because of its place between the simple and complex on the vertebrate scale. The shark skeleton is composed of a gristly, elastic, animal tissue, cartilage, rather than bone. In more advanced vertebrates, such as man, the cartilage appears in the young, only to lessen with adulthood.

An aggressive shark on the move is an unforgettable picture of guile. With his acute sense of smell to lead it, the fish makes its way through the water in smooth and steady manner. Sighting a creature that might make a meal, the shark swerves in that direction. Swimming around the victim, the circles grow smaller, until the attack. Sometimes the shark will hang on like a bulldog, sometimes it will just keep coming back.

Nature, in creating the shark, must have sensed the problem fish it would be, for she gave it simple but tough anatomical equipment, especially powerful jaws



The sand tiger shark obligingly opens wide to show its varied collection of straight and triangular teeth. The jack crevalles swimming beneath do not, however, seem impressed.

COURTESY MARINE STUDIOS

and sharp teeth. This equipment is the key to the shark's survival, while most other early fishes have long since passed from the scene.

The shark's body, with its spindle appearance, is geared to aggressive swimming. Three sets of fins on the back, side, and stomach aid in steering and balancing.

Lacking a definite mouth, the dogfish has a transverse slit on the lower side. This opens to reveal another secret of the shark family's success. In the upper part of the mouth are rows of curved and triangular teeth, pointed backwards; in the lower part, straight teeth. Only the front layer is in use at one time. With the shark's many battles, its teeth, having no roots, break away easily. The other rows act as reserves, and are moved up by strong membranes when a replacement is needed.

Between the nostrils and the mouth are the eyes. Contrary to popular belief, the shark need not turn on its back to bite a victim after sighting it. But it does often do this when attacking an object from the water's surface. Directly back of the eyes are the uncovered and all-important gill-slits, five or six on each side, where the water taken in through the mouth is forced out.

The shark is higher than the most elementary vertebrates, such as the eel-like cyclostome, which lacks jaws, because the shark has paired fins, supports for the gills, a lower jaw, and plate-like scales. However, the shark is not as advanced as the *Pisces* or true fish. It lacks an air bladder, and, when dead, sinks to the bottom instead of floating. It has no true scales, instead, its skin is like sand-paper in which lie hundreds of tiny "teeth." This skin has amazing strength. Also, the shark has no connections or covering to its gristly cartilage.

The shark family has many branches in terms of shape, size, and habits. One species settles down near the shoreline, while another seeks the wide open spaces of the ocean bottom or surface. One has a mouth of large, straight-edged teeth guaranteed to worry even a dentist, while another has more numerous but smaller saw-edged teeth. One is forward and aggressive, and another is sluggish and passive.

Found mainly in tropical waters, the man-eater shark may grow to forty feet. It has a pointed snout, slender tail and powerful tail-fin, five gill openings on each side, a crescent-shaped mouth, and jagged, triangular teeth. Discovery of fossil shark-teeth point to the existence in the past of a ninety-foot white shark.

The basking shark, also of this group, leads a sluggish and passive existence, proved by the uselessness of its small, conical teeth. Its name comes from a lackadaisical practice of basking on the mid-ocean surface. Unusually large gill-slits on each side, a head that seems too small for its massive body, and many rows of teeth, identify this shark. One wine-colored basking shark was found to have twenty rows of teeth, and a ghostly phosphorescent light shone at night from its underside.

Another kind of shark is the porbeagle, with narrow teeth that lack the saw-edged cutters that the white shark uses for seizing and holding prey. Porbeagles usually reach a mere ten feet. Their smallness, however, need not be misinterpreted, for they are notorious for their savagery.

Another member of this formidable branch of the shark family is represented by the thresher, distinguished by the long upper lobe of its tail-fin, which is curved like the blade of a scythe. The thresher uses this scythe-like tail, often as long as its streamlined body, to herd its victims into a mass for easier capture.

Noted for its 12-foot leaps into the air, the mako — close cousin to the thresher — has been known to rip apart a deck and cabin of a launch. Its mouthful of curved teeth help this shark to win many a scrap with its favorite victim, the broadbill swordfish. One captive 720-pound mako was found to have swallowed a 120-pound broadbill.

It is said that the nurse shark is a sluggish and harmless fish that attends to its own business. However, one underwater photographer, working forty feet underwater, gave a jesting pat on the head of what he recog-

nized to be a seven foot, seven inch "harmless" nurse shark. The fish unexpectedly charged. Barely missing the photographer's arm, the shark caught his sleeve. Even when the creature had been killed, the sleeve had to be cut away so the man could be freed.

The eating habits of one nurse shark dismayed its captors. The bulge in its stomach proved to be a wooden crate containing eight unbroken bottles. But this shark is outclassed by the gustatory feats of the vicious and sizable tiger shark. The stomach of one, living in waters where refuse from a nearby slaughterhouse was dumped, yielded the skull of a horse, two hoofs, a few bony-plated green turtles, several large opercula, and a piece of tile.

Amazingly, no tiger shark has been known to die of indigestion. It has chopping and digesting equipment to thrive on gastronomical junk. A flow of hydrochloric acid strong enough to rot a human hand acts as the digestive juices. This acid dissolves iron, and, probably, bone and feathers. Even if the stomach is overloaded, the tiger shark can relax its stomach muscles, squeeze its body cavity, and force out indigestible items.

The tiger shark belongs to a group of sharks having one or two gill-openings above the pectoral or side fin. These sharks also have powerful jaws and curved teeth, and can drop the lower jaw to a vertical position. The mouth also widens, and most prey can be swallowed whole.

A close relative of the tiger shark is the hammerhead, whose head extends outward on both sides, and whose eyes are at the ends of these extensions. The flattened head is used as a rudder, earning this shark a reputation as a fast and agile swimmer. Rivaling the hammerhead in the oddest-of-sharks department is the bonnet head, distinguished by a widening of the head to resemble a wide-brimmed bonnet. Another member of this group, the blue shark, has a nictitating membrane for eyelids, present only in the more recent sharks.

In a class by itself, however, is the whale shark, the largest living fish. Its immense size, wide mouth, parallel ridges, and light dots on its back and sides

easily identify it. The whale shark has small, numerous teeth, long gill-rakers, coverings to protect the gills, like the basking shark. Their habits also coincide, both being sluggish and harmless to man. But, the largest whale sharks are estimated to tip the scales at 25,000 pounds, reaching sixty feet.

The name of the whale shark comes from its manner of feeding. "The Chagrin," as it is nicknamed in some parts, swims along with its wide mouth opened, taking in water and various plankton, small fishes and other small organisms. Then, the water and food go their separate ways. The water is released through the five gill-slits on each side of the body, while the food is filtered out and swallowed. Unlike most of the other shark species, the whale shark's gills are more important in feeding than the 3000 teeth in each jaw. These teeth are a mere one-eighth of an inch long.

Guns and harpoons are often ineffective against the adult whale shark's four-inch armor-plate of rubbery gristle, which tightens or relaxes at will. One monster was harpooned, lassoed by tail, pulled by motor-launch, and shot forty or fifty times without any visible effect.

The eel-like frilled shark, descending from a more ancient species, is named for the six or seven puckered gill-flaps on each side. Its three-pronged teeth are reminders of sharks that lived more than eight million years ago.



A study in variation in shark formation adapted from outline drawings in *Field Book of Marine Fishes of the Atlantic Coast* by Charles M. Breder, Jr.

The sand tiger shark seems to be directing a backward glare at two remoras, or shark suckers, which have hitched a ride on its back.

COURTESY MARINE STUDIOS

The salty seas, however, cannot claim all the sharks. There are the fresh water sharks of Lake Nicaragua in the country of that name. Their presence in fresh water is puzzling since steep waters and currents appear to make it impossible for a shark to enter the lake. However, they have changed little from their ocean days.

A final group of sharks are concentrated in the Indian and Pacific Oceans, and are the more primitive species. They have small teeth in front of their jaws and larger, blunt teeth at the sides to crush shell-fish. The Port Jackson shark has retained the wide fin-spines and special crushing teeth of its now extinct ancestors. A fair-sized kin to the Port Jackson is the Greenland shark, which lives on the ocean bottom, but often rises to attack to do battle with whales.

The rare bramble shark's flabby body is covered with short, sharp spines, suggesting a defensive armor. The flabbiness marks it as a poor swimmer.

On the thin line between the shark and the ray is the small monkfish, or angel shark, which grows to only three feet. Its shape is that of a shark's, and the gill slits are on the side rather than the lower parts.



But its head and trunk are flattened for bottom-living and its pectoral or side fins are enlarged.

The sharks have been around for more than one-third of a billion years. Aided by sharp cutting teeth, as in the aggressive tiger shark, or by overpowering size, as in the passive whale shark, they have been a successful family. Some have managed to preserve the primitive body, as with the frilled or bramble, and some have streamlined it as the mako. Sharks are interesting, divergent, and some live up to the bad reputation that seems to go with the name "sharks."

The Bluejay

By ARTHUR J. WADSWORTH

"Garrulus glandarius"
Such a chatter, such a fuss!
Bluejay; bright-eyed, curious,
Greedy, trigger-furious.
Watch him bury stolen food
(Tucks it under any thing).
If he's in a happy mood,
Listen to him sweetly sing.

When you hear a concert-cry,
You can know a snake is nigh.
Some birds, when the bluejays fly,
May dispute but none defy.
Yet despite the normal noise,
Cannibal meals (which we think wrong),
And the slyness he employs
Listen for his sweeter song!

Though some skeptics doubt my word,
Bluejay warbling joy I've heard:
Soft and shy; in contrast, gay.
Listen for the two-tongued jay!

Nature's Champion Globe- Trotter

By IDA B. ALSETH

The Arctic tern in flight showing the wide wing-spread and the long, forked tail.



WHEN the Air Force boasts about the some 11,000-mile range of its B-36's, one wonders if it does not envy the flight feats of Nature's little flying machine — the Arctic tern.

This little half-pound avian dynamo, which nests in the Arctic, way up to Point Barrow, and winters in the Antarctic, ranges annually some 20,000 to 22,000 miles. It perhaps enjoys more continuous sunlight than any other creature. And it may be that its temper gives it virility, for it has a reputation comparable to that of the termagant Mrs. Rip Van Winkle.

Pugnacious to the core, the thousands of these terns filled the air with their shrill cries, wheeling and criss-crossing like black-tipped silver arrows, as I approached their nesting grounds near the Mendenhall Glacier and the nearby Auke Lake in Alaska.

Unaccustomed to a small bird making little more than a gesture of resentment when threatening an intruder, I was surprised when one swooped down at me with arrow-like speed and accuracy. It barely missed my head. After the first attack, this one was joined by others. They came from all directions, looking like large, black-dotted snow flakes as they whirled all around me.

Some of the birds flew so close that the breeze created by their flashing wings brushed the hair across my face, and made it fairly stand on end. They quickly proved to me that they were not fooling. They were telling me very definitely not to intrude on their breeding grounds.

However, having gone there to study these birds, I was not to be easily frightened, although I tried to be as unobnoxious as possible and not to disturb them unnecessarily. One lad in a tourist party that arrived a little later had wandered away from the others and

came toward me, perhaps out of curiosity. Suddenly a tern shot down with accurate aim, skidded down his forehead, leaving a marked trail of blood. The boy hustled out of the area, holding his forehead as he ran. I could not help but wonder if that is where these little black-capped, gray-robed fellows get their blood-red bills.

Cautiously I moved nearer to what I thought seemed thousands of the birds. Sailing around like forked-tailed swallows, they glided toward me again and again. Others joined in the attack, much like a flock of crows and with about the same raucous protest, which was redoubled by the echoes against the glacier and mountains.

My persistence seemed to lessen their interest in me, but not their belligerency, which they turned toward one another as they fell to quarrelling among themselves.

To see the terns jab at each other with their long, straight bills, gave one the feeling that the redness was due to the encrustment of blood. If a gull, jaeger or hawk flew toward the area, it alerted them like a fire siren. All gave chase, hurling at the intruder their shrill cries of reprimand. In each case the foreigner withdrew in haste, flying low as if that were the swiftest means of escape.

Not so easily intimidated by their bird verbiage, I edged closer to find some nests. Finally, on a little drift thrown up by the waves of Mendenhall Lake, I saw a little depression in the sand. Devoid of any pretense of lining, the nest contained two dark-buff eggs with darker brown patches. In another slight depression on a sand bar was one small, pinkish-billed ball of down that must have been recently hatched. The mother held her position on the nest until I was within a rod or so; then she swept toward me. She circled around

Here is the "Beau Brummell" in all his excellence of dress-derby-shaped hat, white collar, and pearl-gray cloak. His white vest does not show.

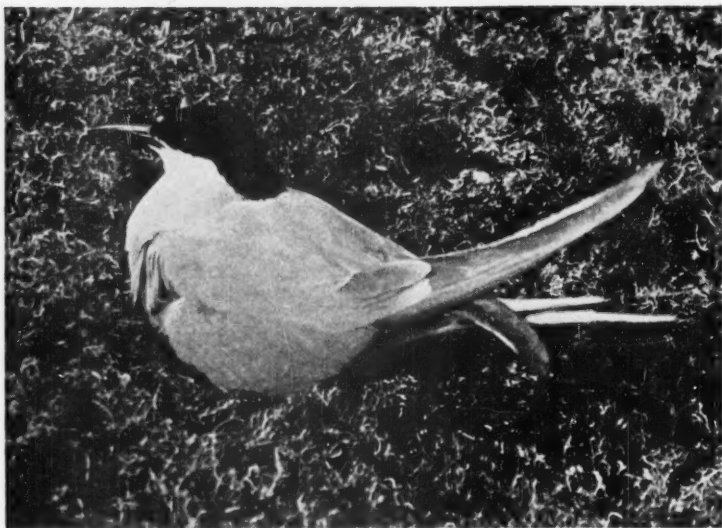
and was soon joined by others who helped in denouncing me.

Later, from behind a dwarf spruce, I watched a hen on the nest that was on the sand well up from the water's edge. While there I saw the male return twice with food for his mate, and he delivered it with quite some pomp and ceremony. He first circled the nest a couple of times as if to alert her to his treat, and then, with a sort of humble curtsy, he presented it to his nesting mate, who took it sedately.

The legs of the Arctic tern are short, and they make the bird look very squat compared with its cousin, the common tern, with which I was acquainted. In flight, however, with their wide wingspread, and long, forked, pointed tail, the Arctic terns look large.

One can scarcely imagine the nests of these birds being so crude. Even the bluejays and the crows go to more trouble. When nests are located so near to the icy-blue glaciers, it would seem that lining would be essential to incubation if the mother was ever to leave her nest. Sand can be as extremely cold as it can be extremely hot.

Evidently the cold does not bother, for Frederick C. Lincoln, in his bulletin on "Migration of North Ameri-



can Birds," describes a nest of an Arctic tern found only seven and one-half degrees from the North Pole. It contained one downy chick that was surrounded by a wall of newly fallen snow that had been scooped out by the parent. Normally these terns lay two eggs, but there may be one or three.

The Arctic tern, *Sterna paradisaea*, is a small bird; at least, its body is. Its forked, streaming tail extends beyond its long-pointed wings, giving it a length of fifteen to seventeen inches. The wide wingspread belies the size of the little body. But there can be no mistake in its identity. Its black skullcap, white collar, and ashen-gray cloak, with its white vest, all contrast so strikingly with its bright red legs and long, straight bill, blood-red to the very tip.

These terns nest in large colonies on islands, sand dunes along the lakes, or on gravel bars at the mouth of streams all along the Arctic coast. Later in the summer I saw others along Kotzebue Sound, and along Kowak River near Selawik, where they also seem to have nested in large numbers.

Many of these were young birds, so identified by their immature plumage, darker legs and lighter shoulder patches. Sea fowl, they can be seen



Near this icy-blue Mendenhall Glacier in Alaska the Arctic terns were found nesting by the thousands.

along the beaches and in brackish sloughs, where they spear crayfish, their favorite food. They also are found near Point Barrow, Cape Halkett and Demarcation Point at Wainright, Alaska.

Probably these birds are most remarkable for their migration, which is the longest migratory journey of all birds. Nesting in the Arctic, why do they travel all the way to the Antarctic to winter? One can see sense in the geese and ducks leaving their northern breeding grounds to spend the winter around the gulf of Mexico with its delightful climate. But the long circuitous route of the Arctic tern seems absurd and time-consuming. Their migratory journey takes around three months, for they are not rapid flyers, cruising along at about 30 to 35 miles an hour.

Their flight pattern remained an enigma until recently. Naturalists knew they nested in the Arctic areas by the thousands. Suddenly, in early September, they dropped from sight entirely and were not seen again until they showed up in Alaska in late May or early June. Where were they in the interim? Some even suggested the probability that they might hibernate. Later they were found in the Antarctic during the winter months. Too, where did they fly that they were not detected anywhere along the way?

It was not until the Federal bird-banding program was in full swing that the riddle began to be solved. Some of the Arctic terns were trapped and the little numbered anklets were attached. They were then turned loose. Although nearly 8000 have been banded, only a dozen or so of them have been recovered at remote places.

One was found in the Niger River delta, West Africa, showing the long distance it had traveled, and suggesting what might be a probable route. Another was picked up near La Rochelle, France, and another near Port Shepstone, Natal, South Africa. As others are being found in remote places, the flight pattern of these terns is taking form, indicating that they go eastward to western Europe and Africa, not north and south.

One theory, rather lightly advanced, is that these birds are sentimental little creatures. It is suggested that they originally migrated from Europe, and, before returning to the Antarctic in the fall, Mohammedan-like visit the Mecca of their ancestral home before continuing on southward along the western coast of Europe and Africa.

However, the tern's trip is not a non-stop flight. Being waterfowl, they can rest as easily on a bobbing wave, eating sea food, as they can on a sandbar. Hence

the birds can afford to be leisurely in their journey. Too, they fly low, as verified by sailors who have reported seeing them in large flocks flying at an altitude of some one-hundred feet.

One banding record proved that it took three months for one of these globe-trotters to go from Labrador to southeastern Africa. If that were true of all of them, they have divided their year quite evenly into quarters, allowing a three-month period for flight to their nesting grounds in the Arctic, three months to rear their young, three months in flight to the Antarctic, and three months there for the winter.

But what a daylight existence these globe-trotters enjoy! They are in the Arctic during the time when it really does not get dark. Before the sun sets, red streaks begin to appear in the east. Conversely they find the same situation in the Antarctic. What sun-

shiny dispositions they should have, instead of being such arrogant, belligerent little "hell-divers."

To watch one of these birds from an obscure position, is to assume it to be a model of amicability. Seeing it with its feathers well-preened, it has the appearance, more or less, of a Beau Brummell with its cocked, black, derby-like hat, immaculate with white collar, light, pearl gray coat, white under vest, and its blood-red hose and boots. It is truly a "chic" bird, and tiny and well-groomed. Yet it stands supreme as a world traveler; Nature's longest range flyer and her globe-trotting champion.

The Arctic Tern

By MORGAN G. BULKELEY

There is one bird that fairly bounds the earth
From North to South, from South to North,
A measurer of meridian in flight,
Black-capped and vested with pure white.

His home is in the land of melting snow
Beyond the furthest Eskimo,
Where endless days of midnight sun
Shine on this cosmopolitan.

His nest is placed with others on the sand,
Along the margin of the land,
As though to taunt and test the surging reach
Of wave and tide upon the beach.

His sport is with the storm and with the sea,
A kind of sailor vagrancy,
Over the shingles of the world pursued
Through longitude and latitude.

How can any creature go astray,
Or any mortal lose the way,
When some strange power can guide this winged
soul
Unerringly from pole to pole?



Hares that Live in Water

By MYRON R. KIRSCH

Photograph by the Author

The sea hare is a tectibranch mollusk dwelling in niches along both our coasts, from mud flats to rocky tide pools. This one was photographed in a low tide pool at Corona DelMar, California.



IN THE teeming tide pools of coastal waters one may encounter an odd creature, called the sea hare, whose earlike tentacles and bulbous body curiously suggests the common hare, or jackrabbit. The sea hare is a mollusk. Whereas most mollusks, like the snails and clams, have their shells on the outside, the sea hare is unusual in that its shell, which is more or less a thin rudimentary plate, is buried deeply within the body. A mature sea hare may reach a length of eight or more inches, and when picked up its fleshy body feels like a piece of wet liver.

Two flaps of tissue extend above the animal's back, and by their rippling motion assist the creature in swimming. As the hare slowly moves about, its shape constantly changes. With head undulating from side to side, the forward part of the body elongates and the rippling hind end follows, accordion-like. Thus the animal can cover a sizable tide pool as it goes in search of food.

The sea hare feeds on seaweed, tearing off bits and passing them through a vertical mouth, over a file-like structure into the first of three stomachs. From the first stomach, which is large and thin-walled, the torn bits of seaweed pass into the second and third, which are thick-walled and provided with triangular-

shaped teeth for further tearing and breaking. The creature, like its namesake, seems to spend most of its time munching vegetation.

Sea hares vary in color from green or yellow to olive-green or olive-brown. Sometimes they are mottled, as the one shown here. When disturbed, the animal often ejects a purplish fluid, which probably serves as a defensive measure. The fluid is quite harmless to humans, although at one time it was not considered so.

Like many other invertebrates, or animals without backbones, the sea hare is double-sexed. It may play the role of male, female, or both. On one occasion, it is reported, a small group of sea hares were observed mating in a circle, in which case each hare behaved as male and female to another. Sea hares deposit their eggs in large, stringy masses, sometimes the size of a large fist. It has been estimated that a single mass may contain as many as eighty-five million eggs.

The sea hare is found along both our coasts in a variety of habitats, from mud flats to rocky tide pools. The specimen shown here, *Tethys californica*, is five and a half inches long, and thrives in tide pools along the coast of southern California. While many interesting animals inhabit our coastal waters, few indeed are as interesting to study as the unassuming sea hare.

The Cuckoo

By HOWE WILLIAMS

I cannot love the cuckoo bird,
Who shirks the cares of motherhood,
Entices others — so I've heard —
By trickery to raise her brood.

Lays her eggs in other's nest
The absent owner to betray;
Then, gloating o'er the sorry jest,
Complacently she flits away.
(I don't care for cuckoo clocks, either.)

DOGS

By E. LAURENCE PALMER

Illustrated by E. M. Reilly, Jr.

*This is the sixty-fourth in NATURE
MAGAZINE's series of educational
inserts.*




Nor long ago the postman who brings mail to my office failed to appear for a few days. Inquiry developed that he had been bitten by a dog owned by a local "big shot." Further inquiry developed that the postman had received only his doctor's expenses to cover the incident. I had no sooner expressed resentment for this miscarriage of justice than my phone rang and I was informed that my pup had ripped the best pants of a neighborhood Beau Brummell. I was delighted that this incident cost me no more than the price of a new pair of pants. I rather think that this incident gives us a good setting for understanding our attitude towards dogs. It all depends on whose dog you are talking about.







A neighbor who resents the occasional yipping of our dog, but apparently ignores the yapping of dogs owned

by other neighbors, once went to her phone at three in the morning to protest the disturbance. She got the wrong number and called one of my fraternity brothers. He accepted her ravings with good grace but the next morning called the lady at three to tell her that he owned no dog. And so the story goes for anyone who owns a dog.

I had the misfortune to have been reared in a dogless household, and the good fortune to have married a lady who grew up with a pack of dogs in the yard, as well as a few in the house. She is president of the local dog training club and I feel lost when there is no dog on the rug beside me as I write these articles. We are just as sorry for our dog-owner friends who do not own smooth fox terriers as they are for us who do not happen to own cockers, great Danes or great Pyrenees. There are audi-

WORKING DOGS

	<p><i>St. Bernard.</i> Varieties: Smooth (standard), rough (long-haired). Brought to Switzerland probably by Roman soldiers. Established fame at St. Bernard Hospice in Alps. Reinvigorated by Newfoundland blood about 1830.</p>	<p>Used originally as work animals, then as rescue animals as pictured by Landseer. Now famous as huge, gentle, intelligent, obedient pets, making excellent obedience test records. Reported to have saved 2500 lives in Alps.</p>	<p>Weight: 150 to 200 lbs. Shoulder height: 25 to 28 inches. Neck: set high, held erect, muscular. Back: broad, arched in loin only. Color: white with red or reversed. Tail: long, heavy, blunt at tip curving upward in last third.</p>
	<p><i>Great Pyrenees.</i> As a breed may date back to 1800 B.C. Member of mastiff group, known in early 1400s as "great dogs of the mountain." Was "royal dog of France" under Louis XIV. Introduced in America in 1824.</p>	<p>Used originally as work animals and as guards. Trained in World War II for use as pack and Red Cross animals, some 25 seeing active service. Highly intelligent, clean, quiet, superior as pets, trustworthy with children and loyal to masters.</p>	<p>Weight: 90 to 125 lbs. Shoulder height: 25 to 32 inches. Neck: short, stout, muscular. Back: straight and broad. Color: all white or with gray tinge. Coat: heavy, able to withstand all weathers.</p>
	<p><i>Newfoundland.</i> May have developed from Great Pyrenees and mixed dogs found on Newfoundland, probably with some blood of Arctic breeds. May be some mastiff in the blood and possibly some wolf blood(?) Commoner in U.S. after World War I.</p>	<p>Used by Newfoundlanders for work, particularly in icy waters as hauling nets or rescuing drowning persons. Intelligent, strong, loyal, superior swimmers, hardy, affectionate. Ideal as a family dog breed particularly with children.</p>	<p>Weight: to 150 lbs. Shoulder height: 28 inches for males; 26 inches for females. Back: broad, straight. Neck: strong, well-set. Coat: flat, dense, oily, water resistant. Color: black or black and white.</p>

	<p><i>Siberian Husky.</i> Originated in Siberia as sledge and guard dogs. Introduced into Alaska for sledge racing in 1909. Closely related to Samoyed, Eskimo and Alaskan Malamute, the Husky being gentler than the related breeds suggested above.</p>	<p>Used as sledge and guard dogs because of loyalty to humans and great strength and endurance, alert, quick, graceful. Possibly less hardy than Eskimo and certainly considered less vicious. Can remain healthy on sparse diet.</p>	<p>Weight: 35-60 lbs. Shoulder height: 20 to 24 inches. Ears: high set, erect, close fitting, slightly taller than wide. Coat: soft, fine, thick, double, of medium length, commonly tan or silver gray or black with white tips.</p>
	<p><i>Great Dane.</i> Origin obscure, but might date back to 3000 B.C., possibly being represented by tiger dogs of Egypt in 2200 B.C. Present characters well established back to 1800, and has blood in other breeds. Was known as German mastiff.</p>	<p>Used as work animals because of strength and tractability. Also used in hunting boars and other powerful and dangerous game. Apparently breed lost vicious temper about 1900. Intelligent, sometimes impetuous, surprisingly strong.</p>	<p>Weight: male at least 120 lbs.; female, 100 lbs. Shoulder height: 28 or 30 inches or over 32 inches. Coat: short and close, black, blue, fawn, or harlequin. Neck: strong, erect. Ears: large, erect. Legs: long, strong.</p>
	<p><i>Boxer.</i> May involve a crossing of English Bulldog (nose and muzzle) and Great Dane (size). Began as a recognized breed about 1900, but since that time type has been steadily standardized.</p>	<p>Excellent watch dog with appearance of threat opposite of normal gentle nature. Short hair improves popularity as house dog. Of great use as war dogs because of stamina, intelligence, speed, courage and alertness.</p>	<p>Weight: 60 to 70 lbs. Shoulder height: 21 to 24 inches. Muzzle: blunt with strong jaws. Body: square, solid, horizontal. Legs: straight, strong. Color: golden yellow to dark red or black, or with dark stripes.</p>
	<p><i>German Shepherd.</i> Began entity as a separate breed of shepherd dog late in last century, when it was developed particularly for police use and later largely for show purposes. Now ranks among first ten in popularity in America.</p>	<p>Has been used as a draft animal, as a police animal, as a "seeing eye," as a movie actor, as a herder of domestic animals, as a watch dog, war dog, Red Cross dog, guardian of children and as a pal and hunting dog.</p>	<p>Weight: 65 to 80 lbs. Shoulder height: 23 to 25 inches. Generally longer than tall, alert, active, with trotting gait. Coat: medium varying from black, through black and brown to light brown and light gray.</p>
	<p><i>Show Collie.</i> Varieties: rough, smooth. Established as a breed for more than 150 years, gaining great popularity in Queen Victoria's time and holding it subsequently, with breeding for beauty gaining popularity in most areas.</p>	<p>Originally bred as a sheep dog, active, intelligent, strong and hardy enough to survive in any ordinary weather. Was probably developed best in Scotland. Smooth collie usually used with cattle; rough, with sheep but from common stock.</p>	<p>Weight: from 50 to 60 lbs. Shoulder height: 22 to 24 inches. Rough has heavy coat except on face and legs. Tail: droops, heavily haired. Color: variable, golden, black, tan or bluish, but usually with a white collar.</p>
	<p><i>Doberman Pinscher.</i> Developed in Germany in late 1800s by Louis Dobermann, using terrier and probably short-haired shepherd blood, as well as Rottweiler to give weight to the shepherd-terrier agility and intelligence, with the modern type becoming standard about 1900.</p>	<p>Developed as strong, fearless, aggressive animals of much spirit and intelligence. It is an all-round breed that demonstrated its superior qualities as a war dog with the Marines in the Pacific, during World War II, and later in obedience and show competition. Elegant in appearance.</p>	<p>Weight: 65 to 75 lbs. Shoulder height: 24 to 28 inches. Tail: usually docked. Neck: long, strong, erect. Legs: clean, strong. Coat: short but thick and hard, smooth and close. Color: usually black and tan or with red.</p>

ences where I am better known as the part owner of Pooh than as a member of the faculty of a great university, or as a regular contributor to a great magazine.

When I think of my close association with as homely a dog as Pooh is, I wonder if there is anything in the assertion I heard made at a recent obedience trial that owners and dogs look alike. Certainly I know of humans built like greyhounds, bulldogs, setters, cockers and mutts. Sometimes the resemblance between dog and master is obvious, but I like to think that it is not always so — particularly when I look at Pooh. When I think of Pooh's personality, of the loyalty of Tiddley, the friendliness of Petey, the independence of Wow and the sense of humor of Tia, I have no resentment in being associated with my dogs. They are or were all smooth fox terriers, except possibly Pooh. Of him a judge once asked: "He is a fox terrier and what?" Since I attended his beginning in life I resent the remark, but it is obvious that somewhere in the line of his ancestry someone was a bit careless. This reduces the pup in my esteem not in the least. It was not his fault. And I like to think that the bar sinister principle is worth thinking about, whether we are concerned with dogs or humans. In spite of this obviously generous attitude on my part I find it difficult to understand the enthusiasm for their pets voiced by owners of breeds other than fox terriers. I am sure that even owners of wire-haired fox terriers must be just a bit off the beam. The friendly banter that goes on between dog owners means a lot to many of us, and unless there can be some assurance that there are dogs in Heaven I rather think a few of us might have reservations as to the desirable qualities of the place, if it is a place.

The Dog as an Animal. Six to twelve blind puppies may be born from 59 to 63 days after a pair of dogs breed. The youngsters are unable to hear for the first 10 to 12 days. They nurse their mother until they are from 4 to 8 weeks old, become biologically independent and able to reproduce their kind within a year. The female is in heat once a year, for a period of from 1 to 3 weeks. The normal maximum life span is 20 years.

The age of puppies may be determined by their teeth. Of the milk teeth, the 1st and 2nd incisors appear at 4 to 5 weeks of age and the 3rd incisors at 4 weeks. The canines appear at 3 to 4 weeks; the 1st and 2nd premolars at 4 to 5 weeks; the 4th premolars at 3 to 4 weeks. With the permanent teeth, the canines and incisors appear at 4 to 5 months, the premolars at 5 to 6 months, the 1st molars at 4 months, the upper 2nd molars at 5 to 6 months, the lower 2nd molars at 4½ to 5 months and the 3rd molars at 6 to 7 months.

The normal body temperature of a dog is 101° to 103°F., the respiration, 15 to 20, and the pulse, 70 to 120. Dogs differ from wolves in that they lack hair between the toes, slanting eyes, curved canines, the sharp muzzle and the dense underfur of the wolf. From 8 to 12 weeks of age dogs are highly susceptible to attacks of distemper, which may prove fatal, but may be prevented by the use of serums. They may be attacked by rabies and become serious menaces to other living things but this may be

kept in reasonable control by the use of vaccines.

The Dog and Man. Dogs have contributed in highly important ways to an understanding of the diseases of human beings, and of the functions of the parts of the human body. They have worked for man as draft animals in snow and over dry lands. They have rescued many men from drowning, have warned families of fire danger and of the approach of enemies. They have given their lives in combat for the protection of their friends. In some parts of the world they are considered as being a delicious food. They assist men enormously when other animals are being hunted, have found lost persons and assisted in the capture of escaped and dangerous criminals.

Man has controlled the heredity of most dogs, and through selection we have animals that are masters of speed, of strength, of intelligence. They may have remarkable ability to see, to hear, to smell and possibly to sense in ways we cannot appreciate at all. They may make ideal companions, and as "seeing eyes" for blind folk give new hope to persons whose outlook on life might well be highly discouraging. Through control of the heredity of dogs men have assisted in the development of dogs that seem to be ridiculous.

Because of the great variation in dogs a classification has been established. The breeds here considered would appear in this classification as follows:

Group 1. Sporting Dogs: pointers, retrievers, setters, spaniels.

Group 2. Sporting Dogs (Hounds): beagles, foxhounds, bloodhounds, greyhounds, elkhounds, whippets, weimeraners.

Group 3. Working Dogs: boxers, collies, Doberman pinschers, shepherd dogs, great Danes, great Pyrenees, Newfoundlands, huskies, St. Bernards.

Group 4. Terriers: bull terriers, Cairn terriers, fox terriers, Manchester terriers, Skye terriers.


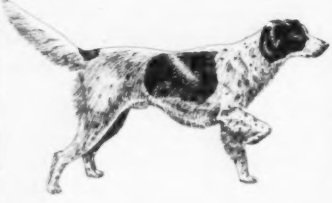




Group 5. Toys: Chihuahuas, Pekingese, Pomeranians, pugs.

Group 6. Non-sporting Dogs: bulldogs, Dalmatians, poodles.







To maintain and improve dogs in these and in other breeds, the kennel clubs and breeders associations have set up close standards to which they adhere. Unfortunately these are not the same in all countries, although they are approximately so.

Probably the most interesting development in man's experience with dogs centers around the dog training classes and the obedience classes. Anyone with a dog that gives trouble, or that does not, should make an effort to identify himself and his dog with an obedience class and should enter some of the regional meets where dogs of similar heritage compete with one another. Training for obedience and for show purposes are two different things and should not be confused. For further information on this we recommend, without reservation, Jack Baird's little book, *The Care and Handling of Dogs*, listed in the bibliography at the end of this article. It sells at a nominal price at most news stands.







SPORTING DOGS

	<p><i>Labrador Retriever.</i> Known to have been introduced into England by 1835 from Newfoundland and believed to have been developed by Labrador fishermen. Preceded in American popularity by the Curly-coated and Chesapeake Bay retrievers.</p>	<p>One of the best of the game retriever dogs, able to swim readily in ice filled waters better than the longer haired varieties. Makes excellent show dog and does well in obedience trials. Also good as a house dog and as companion for children.</p>	<p>Weight: 55 to 70 lbs. Shoulder height: over 21 inches. Neck: short and solid. Tail: drooping, thick at base and tapering. Coat: short, dense, waveless, hard. Mostly black but some are a golden yellow to brown but usually all one color.</p>
	<p><i>English Setter.</i> Setters include Irish, Gordon, Lovat, Seafiel, Featherstone and others, including the Russian setter. Probably evolved from spaniel group, but is America's oldest breed of hunting dog, and of these the English is the oldest.</p>	<p>A superior dog to work in field in front of a gun, and also excellent as a show animal and pet. Its long hair makes it less popular as a house dog than its nearest hunting rival, the pointer. It is designed to find and point to game in the field.</p>	<p>Weight: 55 to 75 lbs. Shoulder height: 23 to 25 inches. Neck: long, lean, arched near head with sparse throat. Back: straight or sloping upward, forward. Coat: long-haired, flat, without curl, with thin feather on legs. Tail: straight, set low.</p>
	<p><i>Pointer.</i> One of the oldest breeds of hunting dogs, being probably the first trained to stand at point before game. Breed known in England as far back as 1650, reaching there possibly from Spain or Portugal. Sustained popularity.</p>	<p>Designed to hunt birds in thick cover, its short hair not holding burs but its extended head, tail and straight back holding a beautiful point when in action. Affectionate, intelligent, with excellent nose and good hardiness and pluck.</p>	<p>Weight: 55 to 65 lbs. Shoulder height: 23 to 25 inches. Neck: moderately long, slightly arched. Body: short and strong. Coat: short, flat, firm, colored white or black and white or liver and white or spotted or may vary greatly.</p>
	<p><i>Cocker Spaniel.</i> Spaniels include Cocker and English Cocker, Irish, Brittany, Clumber, Field, Springer, Irish Water, Sussex and Welsh. Three varieties include Blacks, any other solid color and parti-colored. English larger.</p>	<p>Developed to assist in hunting birds such as woodcock. Hunts actively and retrieves well when trained. Makes an excellent house dog for small quarters for a long-haired breed. Does well in obedience trials and in shows.</p>	<p>Weight: 18 to 24 lbs. Shoulder height: withers height should equal length from withers to base of tail. Ears: large, drooping. Coat: silky, dense, feathered, flat or waved, abundant. Active, intelligent, loyal, obedient and an excellent pet.</p>
	<p><i>Irish Water Spaniel.</i> Have been show dogs for more than a century being developed probably in Ireland, with North Country and South Country varieties known. Quite different from most other spaniels and easily identified as shown later.</p>	<p>Developed primarily as a dog for use in hunting and as a watch dog. Takes readily to water in any season. For this reason is popular with duck hunters. Is the tallest of all the spaniels and has wide popularity.</p>	<p>Weight: 45 to 65 lbs. Shoulder height: 21 to 24 inches. Has top knot on head and a rat-tail tail. Coat: no feathering. Hair curly and thickly matted but not woolly as in poodles. Color: solid liver. Ears: long and drooping, heavily haired.</p>
	<p><i>Weimaraner.</i> Originated in Germany more than 125 years ago but kept strictly German. In 1929 two dogs were brought to America, followed by others that established the breed in America. Probably developed from the Schweisshunde that resembles bloodhounds.</p>	<p>A superior all-around dog that retrieves, points and trails and is, in addition, a superior house dog. Carefully guarded in America and Europe to maintain its qualities unmixed with other breeds. Probably newest breed in America.</p>	<p>Weight: 55 to 85 lbs. Shoulder height: 22 to 26 inches. Has appearance of a smooth, slick dog with blue-gray or amber eyes, blue-gray coat, with no white except rarely on chest. Tail is docked to $\frac{1}{2}$ to $\frac{3}{4}$ normal length. Coat is woolly under sleekness.</p>

HOUNDS

	<p><i>Bloodhound.</i> Breed has been established since 12th Century according to church records. Name is a corruption of "blooded hounds" or purebred hounds, not animals interested in bloodthirsty deeds. Disposition gentle, and kindly, not villainous.</p>	<p>Bred because of uncanny skill in following trails, one known to follow a trail 150 miles and another to follow a trail more than 100 hours old. One dog credited with trailing successfully more than 600 criminals in the United States. Generally misunderstood.</p>	<p>Weight: 80 to 110 lbs. Shoulder height: 23 to 27 inches. Sober looking dogs with sleek coats, long drooping ears, usually drooping tails, heavy necks, powerful forequarters and friendly dispositions. Useful in finding lost persons as well as criminals.</p>
	<p><i>Beagle.</i> An ancient breed believed to have been developed in ancient Rome and known to have been popular in England under Henry VIII, and Queen Elizabeth. Two sizes are recognized in the show ring with 13-inch height dividing line.</p>	<p>Developed as a hunting dog, particularly for trailing rabbits. Also makes an excellent house dog without losing ruggedness for the field. Will work individually or in packs. Affectionate, intelligent, clean, vigorous and active.</p>	<p>Weight: around 30 lbs. Shoulder height: 15 inches or under, as contrasted with foxhounds 22 to 25 inches. Like a compact but not coarse foxhound or a slender, alert basset hound. Coat: close, hard, of medium length. Any hound color.</p>
	<p><i>Norwegian Elkhound.</i> Probably much like the breed of 5000 B.C. Brought to America from England and from Norway, and growing rapidly in popularity in America. British Elkhound Society founded in 1923, the first animals coming to England about 1878.</p>	<p>Designed as a powerful, all-purpose hunting dog capable of handling elk, bear, boar or smaller game. Tireless, hardy, courageous and intelligent. Excellent as a house dog and guard. Not a fast hunter but most persistent.</p>	<p>Weight: 43-50 lbs. Shoulder height: 18 to 20½ inches. Stocky build with tail high-set and curled over back. Coat: heavy, coarse, weather-resistant, gray with black tipped hairs, particularly heavy around shoulders.</p>
	<p><i>American Foxhound.</i> Apparently developed from stock introduced into America in 1650. Early colonists maintained packs of foxhounds. English foxhound pedigrees trace back to 1800, while ours have more obscure records. Washington admired the breed.</p>	<p>Bred for skill in following a trail, stamina in maintaining the hunt and fine voice in advising hunters of the progress of the game. Excellent as a house dog and personal pet. Animals are fast, intelligent, loyal and work well in groups.</p>	<p>Weight: around 50 to 60 lbs. Shoulder height: 21 to 25 inches. Neck: long, clean. Legs: powerful and straight. Hind quarters: strong. Girth of chest of 24-inch dog about 31 inches or over. Color unimportant.</p>
	<p><i>Whippet.</i> Established as a breed in mid 19th Century, being developed from the greyhound with a mixture of Italian greyhound and terriers, such as Manchester and Bedlington, as well as old English white terrier.</p>	<p>Bred primarily for racing or for running small game such as rabbits, but has courage and makes an excellent rat killer. Speed is the essential quality sought, but animal is an excellent household dog and pet.</p>	<p>Weight: under 20 lbs. Shoulder height: 18 to 20 inches. Neck: long. Head: slender. Body: lean. Tail: long. Legs: slender but strong. Coat: smooth, close, firm. Color: unimportant. May be fastest animal of its size.</p>
	<p><i>Greyhound.</i> Breed was established as far back as 4000 B.C., and it is suggested that it survived long before as a native dog. Reached Europe in 8th Century but it appeared in mythology as early or earlier. Varieties include wire-haired, rough-haired, smooth-haired.</p>	<p>Developed primarily to capture game by pursuit, or to drive it where it may be killed. Depends more on sight and speed than on scent, and may be used in a mixed pack for its specialty. Now used mostly in racing and for show and as pet.</p>	<p>Weight: 60 to 70 lbs. Shoulder height: about 30 inches. Neck, body, head, legs and tail: all slender. Coat: close and sleek. Ears: drooping. The hero of many a dog-racing track and the favored pet of many homes.</p>

TERRIERS

	<p>Smooth Fox Terrier. Varieties include the smooth and the wire-haired. Of these the smooth has been the longer established. Saddler, the most famous smooth, completed in 12 years a show record not matched by other breeds or dogs and sired more champions than any other.</p>	<p>Bred originally as a sporting dog for keen nose and eyes and for aggressiveness. It ran with the pack and went into the fox hole to drive the fox out after it had entered. An excellent pet and house dog, and the writer's outstanding favorite.</p>	<p>Weight: about 18 lbs. Shoulder height: not over 15½ inches. Neck: strong, erect. Tail: docked to ¾ and erect so tip is even with top of head. A good dog for small quarters if any dog must be subjected to such treatment. A perfect pal.</p>
	<p>Wire-haired Fox Terrier. A variety of fox terrier more recently developed than the smooth variety, but still was established at least 200 years ago. Fox terriers are of English origin, with standards established in 1876.</p>	<p>More a show dog than the smooth, but yet unable to match the record of Saddler. An excellent house dog, and, like the smooth, is excellent as a watch dog. It is active, intelligent, hardy and generally snappy in appearance.</p>	<p>Weight: about 18 lbs. Shoulder height: about 15 inches. Head: about 7 inches long. Coat: of longer hairs than in the smooth, particularly about the head. The wirier and coarser the coat the better for show purposes.</p>
	<p>Bull Terrier. Developed in England with breed established at least 100 years ago. Evolved from crossing English Terrier with bulldog and pointer. Varieties include white and colored, the white being known as white cavalier.</p>	<p>Bred chiefly for pit fighting when such practices were considered as being humane. More recently some vicious qualities have been bred out, but some of us have persistent memories of unforgiving natures.</p>	<p>Weight: from 25 to 60 lbs. Shoulder height: around 19 inches. Stockily built but streamlined, with wide-spread strong legs, short erect ears and straight slender tail. Colors vary.</p>
	<p>Manchester Terrier. Developed in the vicinity of Manchester, England and known as the Black and Tan Terrier. Has some whippet in its ancestry and is found in miniature varieties, and its popularity is definitely on the increase in some areas.</p>	<p>Developed primarily as a ratter, but has all the qualities of a superior house dog and pet. Has speed, beauty and endurance, drive and intelligence, and has been used in developing other types because of recognized good qualities.</p>	<p>Weight: 14 to 22 lbs. Height varies down to miniature form that stands 12½ inches at the shoulder. Much like the bull terrier but lighter in weight. Color is black and tan with the black sleek and glistening.</p>
	<p>Cairn Terrier. Developed in Scotland with longer body than the Sealyham, Scottish and West Highland White Terrier, but shorter in body than the Dandie Dinmont. May have been originated in Isle of Skye, and have been modified in some strain to form Skye terrier.</p>	<p>Developed for use in packs in hunting and driving from their dens foxes and badgers, or in pursuing otters in the water. In spite of utilitarian record is useful also as superior pet and house dog. Brought to America early in the century.</p>	<p>Weight: about 14 lbs. Shoulder height: about 9 or 10 inches. Body length: about 15 inches. Coat: shaggy, particularly forward and on belly and legs. Ears: short, erect, relatively small. Head: short and broad.</p>
	<p>Skye Terrier. Developed in Scotland probably from Cairn terrier and yet it has been an established breed for some 400 years. Was greatly admired by Queen Victoria whose sanction increased its popularity. Varieties include droop-eared and prick-eared.</p>	<p>Developed primarily for pursuing game into burrows and among crannies in rocks and for other rough country. It has the properties of a good house dog but can survive severe weather outside if necessary and has done well in shows.</p>	<p>Weight: about 14 lbs. Height at shoulder: 9 inches. Overall length: 39 to 41 lbs. Coat: heavy, shaggy particularly about the face, legs and belly. Eyes: almost completely hidden. Sense of scent and hearing: highly developed, and speed excellent.</p>

Show competitions and obedience trials place the burden of competition on both the dog and its trainer. In each case there are series of competitions through which a dog and its exhibitor go to reach the top. These are so selected that a wide geographical representation of competitors prevents awards being given in communities where high standards are not maintained. In the obedience trials a dog may win his C.D. (companion dog) only by competing before a number of judges where enough individuals are represented to make the award significant. The reward that comes with these experiences is apparent in the improved behavior of the dog, and the mutual affection that develops when a dog and its trainer win an award. In the obedience trials the only reward a dog gets is commendation, and the only punishment administered is the withholding of commendation.





Obedience classes not only train individual dogs and

owners how to behave, but there are class competitions in which groups present programs involving the co-operation of all. These group activities provide good programs for presentation before schools, Scout groups, camps and other gatherings. Incidentally they help show people what can be done to make a dog a really useful companion, and, best of all, they show that results can be produced without the severe punishment that was once thought essential, and without the use of food as a reward.

Dogs in Literature. The literature of dogs is prodigious if we interpret it in any way. If we interpret literature to include human expression through art, through films and other devices, as well as through the printed page, it is almost phenomenal.

Beautiful Joe gave many of us a mind set on dogs, even though we were not allowed to have the animals as pets in our homes. The works of Landseer were before us on

TOY DOGS

	<p><i>Pomeranian.</i> Developed from Spitz blood with something of the strain of Lapland and Iceland sledge dogs in the line, but bred to share close quarters with humans. Varieties include black, brown or chocolate, sable, red, orange or cream.</p>	<p>Obviously a toy dog developed for show or for the lap. Small size has not reduced the sense of importance of these little animals, and this may get them into troubles they cannot correct. Make good pets, however, and as such are popular.</p>	<p>Weight: about 7 lbs. with classifications made above and below that figure. Coat: double, the under being fluffy and the outer long and straight and usually shining. Has conspicuous collar or frill.</p>
	<p><i>Pekingese.</i> Developed in China, where it was known as the Lion Dog of China and known in Korea in at least 2000 B.C. Were used as ceremonial dogs in China, but were brought to Europe by British in 1860. In ancient China theft of a Pekingese brought death to thief.</p>	<p>Obviously bred as pets and as ceremonial dogs. In Europe and America in modern times they have ranked high as show dogs and for household pets, although to some they seem ridiculously out of character for a dog. They are alert and affectionate.</p>	<p>Weight: under 14 lbs. Characterized by small size and heavy coat of long hairs, dark face with eyes free, long hiding hairs. Tail: curved over back and long-haired but hair always straight and neither curled nor waved.</p>
	<p><i>Boston Terrier.</i> Distinctly of American origin and developed in Boston about Civil War times or later. Was probably developed from a cross of English bulldog and white English terrier. Did not gain official recognition as breed until about 1893.</p>	<p>Developed as a peppy, alert small house dog particularly popular because of neat appearance, cleanliness, short hair and obvious interest in people. One of America's most popular breeds, and justly so.</p>	<p>Weight: in 3 classifications; — under 15, 15 to 20, and 20 to 25, although early dogs weighed more than 30 lbs. Height: of course varies with weight classes. Has some of the stockiness of the bulldog but the drive of the terrier.</p>
	<p><i>Chihuahua.</i> Varieties include short-coated and long-coated, obviously differing from Mexican hairless in this character. Evolved in Mexico and is found probably at its best there, although it has high popularity in United States.</p>	<p>Developed as a toy dog and as a house dog. More independent and therefore less trouble than some other toy house dogs. As is case with most toy dogs the Chihuahua was once owned only by more favored groups of men. It now has wide popularity.</p>	<p>Weights: 1 to 6 lbs. in smooth and 2 to 8 lbs. in long-coated types. Like diminutive terriers in appearance and to some extent in behavior. Color varies from pure white to black, or some with color splashes. Known from 5th Century in Central America.</p>

the walls of homes, schools and in the press, and they conditioned us to a kindly appreciation of canines.

Vicariously through literature of various sorts we could run the gamut of emotions about dogs. *Bob, Son of Battle*, the Terhune stories, Seton's *Wulley and Chink*, *The Bar Sinister*, all molded our convictions. Then came "Lassie", "Bugle Ann" and "Rin-tin-tin."

There is a rich literature on dogs that we cannot list here obviously. I elect to list the dozen or more that have intrigued me sufficiently for me to purchase them. They may interest you. There are many more, including the excellent books of Judy Publishing Co. of Chicago.

Ackerman, I. C. and Kyle Onstott, *Your Dog as a Hobby*, Harper and Brothers, New York. 1940.

Baird, Jack. *The Care and Handling of Dogs*, Perma-books, New York City. 1948.

Curtis, Paul A., *Sportsmen All*. The Derrydale Press, New York City. 1938.

Davis, Henry P., Editor, *The Modern Dog Encyclopedia*,

Stackpole and Co., Harrisburg, Pa. 1949.

Fuertes, Louis Agassiz, *The Book of Dogs*, National Geographic Society, Washington, D. C. 1919.

Johns, Rowland and Leonard Naylor, *Dogs for Profit*. E. P. Dutton and Company, Inc., New York. 1937.

Lawson, James Gilchrist, *The Book of Dogs*, Rand, McNally and Company, Chicago. 1934.

Lemmon, Robert Stell, *About Your Dog*, Frederick A. Stokes Company, New York. 1928.





Reynolds, Don, *Champion of Champions*, Random House, New York, 1950.

Rine, Josephine Z., *The Dog Owner's Manual*, Tudor Publishing Company, New York. 1936.

Saunders, Blanche, *Training Your Dog to Train You*, Doubleday and Company, Inc., Garden City, N. Y. 1946.

Skelly, George Frank, *All About Terriers*, Orange Judd Publishing Company, New York. 1948.

Vesey-Fitzgerald, Brian, *The Book of the Dog*, Nicholson and Watson, London. 1948.

	<p><i>English Bulldog.</i> Obviously of British origin and was a recognized breed in England as early as 1500. It probably has some mastiff blood in its origin and also some Great Dane. With the outlawing of bull-baiting in 1835 the breed began to lose popularity.</p>	<p>Bred to bait bulls and so required rugged build and persistence. This character was admired by the British citizen in the days when it was proud of its independence, and the bulldog spirit was considered synonymous with British spirit.</p>	<p>Weight: 40 to 50 lbs. Of phenomenally stocky build with greatly developed under jaw and wide-spread legs that could provide resistance to dragging. Coat: short and sleek. Color: highly varied but usually with irregular pattern. Modern bulldog a gentle, pleasant pet.</p>
	<p><i>Pug.</i> Came originally from China, but reached England through Holland and its Dutch sailors. Was developed further in England and in early part of this century found great popularity in America. This is gradually being regained in some areas.</p>	<p>Excellent as a house dog because of its cleanliness and watchfulness about strangers. It makes an excellent show dog and has a surprisingly good record in obedience trials. In short, it is an all-round dog for the house.</p>	<p>Weight: from 14 to 18 lbs. Stockily built or "cobby" with blunt head, dark face, tightly curled tail, short, close, sleek coat and strong chest and body. Good stamina and excellent intelligence.</p>
	<p><i>Dalmatian.</i> Apparently was developed by gypsies who wandered from place to place. Whether it originated in the province of Dalmatia or not is a controversial question with which we will not be concerned. It is an old, long-established breed, however.</p>	<p>Developed as a hunter, a destroyer of rats, a guard, a coachdog, a shepherd and even as a draft animal, in all categories of which it could succeed. It is loyal to its masters but not always friendly with strangers.</p>	<p>Weight: 35 to 50 lbs. Shoulder height: 19 to 23 inches. In many respects is like the pointer but its characteristically spotted coat is not found so well developed in any other breed. Spots rarely larger than silver dollar (if that is familiar).</p>
	<p><i>French Poodle.</i> Varieties include toy, miniature and standard, the differences being primarily in size. Standard is more than 15 inches high at shoulder; Miniature, from 10 to 15, and Toy under 10. Colors vary widely and coat variation is fantastic.</p>	<p>Bred originally as hunting dogs, but its intelligence has won it a prominent place as a circus performer and in shows and in obedience trials. As a house dog it is superior and it hunts equally well on dry land or in water.</p>	<p>Weights vary greatly with the varieties. Heights: given. The most conspicuous part of the poodle is its long-haired coat that is trimmed crazily for show purposes but usually the mop on head and shoulders remains large and conspicuous.</p>

Cattails

By HAYDN S.
PEARSON

THOUSANDS of years ago primitive man used the cattails' long, slender leaves and tall blossom spikes for motifs in rough drawings. As you watch the brown cylindrical heads develop in marshes, sloughs and creek bottoms, you are observing a plant scattered over North America, Asia and Europe. In the warmer regions of these continents, the narrow-leaved cattail takes over; this variety has leaves approximately a half-inch in width, and a short, bare section of stem between the staminate and pistillate parts of the fruiting spike.

In cooler climates, the leaves are often six feet in length and an inch in width. The leaves point upward to prevent shading; they are covered with a waxy bloom, which prevents moisture clogging the pores. The dense flowerets are in compact spikes, the staminate above the pistillate, and an occasional flower spike is eight feet in height. It is the bractless pistillate flowers tipped with the rich reddish-brown that makes the familiar midsummer picture. By late August only a few lingering remnants of the staminate flowers remain at the top of the stem.

The rootstock is spongy, coarse, and filled with white starchy material. Thousands of years ago the Indians dug roots in the spring and from them made a stew. History records that when Captain John Smith was having labor troubles in Virginia with the English dandies, hard-pressed settlers broiled the young cattail heads for soup. Indian squaws gathered the soft down and used it to line their papoose boards; braves used the down to line their moccasins. Pioneer housewives gathered the strong stems in autumn and used the hollow stalks as candle molds. Half a century ago, village lads soaked the cattail heads in kerosene and waved the flaming torches in political parades.

There are some ten species grouped in a single genus, *Typha*. New stems grow each spring; each new stem



develops into a single plant. Within a few years after a plant starts in a new location, a whole marsh or lowland may be taken over. In an area of cattails one rarely finds any other plant because of the habit of interlocking rootstocks. In some areas the fluffy fruits are used as pillow fillers, and the long, strong leaves are woven into chair seats. Oldtime woodsmen say the young fruits made good eating and called them "Cossack asparagus." The writer's research does not divulge the reason for this name.

Fernald and Kinsey, in their *Edible Wild Plants of Eastern North America*, report that the cattail has enjoyed considerable attention as a food plant. The short, thickened leading shoots of the rootstock are well filled with starchy material late in autumn and through the spring and have been used as a cooked vegetable or salad. A jelly has also been extracted from the root. Also the young shoots have been used for pickles and are eaten raw or boiled and in soups.



What does this highway fatality, typical of so many forms of wildlife victims of the motor age, mean in terms of wildlife population. In this article Mr. Shepard, wildlife specialist, presents a picture of an intricate and interesting subject.

Our Highways and Wildlife

By PAUL SHEPARD, JR.

Illustrated by Richard B. Fischer

PART of the sound effects of any highway in America is the thumping tattoo of falling wildlife. To the sympathetic observer this sound is apt to drown out the singing of the survivors and the rustle of the yet-living. This traffic toll is often lamented in articles and resolutions without considering the lack of conclusive information on the subject. Worse yet, each traffic victim's death is a calamity unredeemed by our failure to realize its ecological lesson. This crude display of death in public places unfortunately provides one of the few contacts with vertebrate wildlife that many people regularly experience.

The importance of ecology in terms of our own survival is well recognized, but if the man on the street is to see himself as a member of a community including moles, starlings, spiders, and fungi he must be deluged with dramatic examples. The conservationist's dream of heaven is access to the artifacts of modern advertising and political propaganda. Lacking them, we should bend ecologic windfalls to our use.

The death of a rabbit on the highway is potentially a more impelling attraction than a billboard. Perhaps this highway drama, like the La Brea Tar Pits, offers a distinct viewpoint on Nature. Faced unemotionally, the subject has many facets. For instance, research indicates that each species of wildlife has a home area, a definite range of mobility in which the activities of life transpire. A deer usually stays within an eight-mile radius of home, a box turtle within four hundred feet, and a covey of quail or a cottontail within one-half mile.

Any rabbit whose radius overlaps a road lives under the shadow of the automobile, exposed regularly to speeding cars. When killed, it is replaced if the local

rabbit population is healthy, and the replacement in turn is liable to a sudden end. Does this sound like an unlimited drain on our supply of rabbits?

Field work is showing that Nature is always juggling the causes of death, but in the long run sweeps away only those animals above the "carrying capacity." If the land can support only so many, *something* will happen to the rest. Where roads extract a toll of rabbits a fox has moved out, some rabbit disease is slightly less widespread, or the knife of starvation is dulled. The farm wildlife population, and the balance of forces upon it, probably adjusts to the highway kill by a reduction of deaths elsewhere. The rabbits whose paths do not cross highways serve as a source of supply, regardless of the nature of fatalities.

Has the highway heightened your interest in rabbits? The race is worth knowing. The one stupified by headlights and run over is survived by others with better wits. These are many things. They are a potential weed species whose numbers sometimes zoom when the environment is sick from fire, plow, cow, or axe. Each is a token of soil fertility, whose bones grow hard on good land, small and soft on poor land. The rabbit is the staple of the coyote, fox, owl, and hawk, which they prefer to chicken. It is an important game animal, a cog in the multiple gears of existence. It will survive in spite of highways if it has food and cover.

On the other hand, a herd of mobile animals, like deer, could conceivably be decimated by automobiles because every member may cross roads regularly. Thus, the 644 deer fatalities compiled by S. W. Jackson in seven Pennsylvania counties during the past decade seem more serious than the loss of 17,028 opossums in the same area. The joker in the matter is that much of

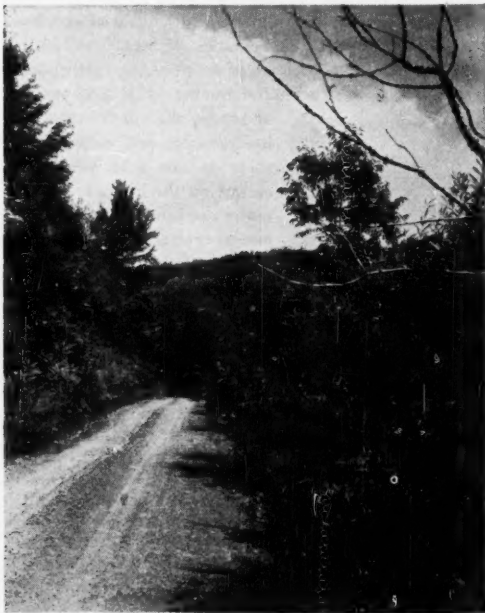
"This crude display of death in public places unfortunately provides one of the few contacts with vertebrate wildlife that many people regularly experience."

Pennsylvania has more deer than the range can support anyway. The figures mean little without a knowledge of the total deer population in those counties, and how many deer the area can support.

This picture of animal mobility and highways only helps prove the common belief that no description of Nature can be static. The intensity and speed of traffic varies widely on different roads. The annual mechanical improvement in automobiles is another changing factor. Notions about what people feel are "desirable" species are involved. No conclusion would be applicable anywhere except in the locality where the information was gathered. This may vary with changes in the composition of the population and seasonal activities. A bird that winters in Peru is exposed to highway kill only part of the year.

Instinctive changes in behavior can influence the problem. For example, under "normal" circumstances the squirrel is an occasional traffic victim. But periodic mass movements occur when large groups of these arboreal rodents begin to move steadily through open fields and rivers, crossing everything in their path like a flood of lemmings. During one such migration in the Missouri Ozarks a few summers ago the bodies of fox squirrels lined the highways. By providing information, motorists might help solve these enigmas of animal behavior.

Highway building is frequently a violent blow to



natural habitat. J. Hammond Brown writes of the startling effects of construction along the Alcan Highway on the distribution of wildlife. Some species are driven farther into the corners of wilderness by the very presence of men. We hope that permanent wilderness areas will help save some of these. This upheaval along our dying frontiers is actually a separate problem.

Millions of miles of America's hard-surfaced roads are decades old. Most of them have stabilized banks, borders of trees, and brushy fencerows which form "edge." Most of the wildlife needs edge to thrive. Intensive agriculture has crowded out many of these creatures. In open country, besides fencerows and streambanks, *roadways* provide the only cover for animals otherwise dispossessed. In forested regions the highway "opens" the woods, creating edge there also. The remarkable fact is that much wildlife not only fails to avoid roadways but is concentrated along them. There they find nesting cover and den sites, wild fruit and flowers, connecting pathways through open fields, perches, moisture, humus, many of the kindred essentials of life. Think of the many species of birds you look for along the roadside!

Big animals, such as coyotes, foxes, moose, and deer, are drawn to the highway as a trail. Indeed, many New England roads grew out of Indian paths that had originally been game trails. On one of these that passed along the side of a steep hill a New York man counted scores of small mammals stricken by cars. After months

"In open country, besides fencerows and streambanks, *roadways* provide the only cover for animals otherwise dispossessed."

"The killdeer and other plovers occasionally nest beside gravel roads."

of observation he concluded that this road cut was used by squirrels, rabbits, muskrats, and skunks to "get places." Here they were trapped by cars as they occasionally are on bridges.

The mourning dove, whose muscular gullet requires small stones to grind seeds, eats road gravel. But the bird risks its life to do so and sometimes loses the gamble. Yet, whoever has counted nesting doves along Iowa roads may wonder whether the highway kills or produces more doves.

The killdeer and other plovers occasionally nest on gravel roads. Woodpeckers, bluebirds, starlings, and sparrow hawks nest in telephone poles and fence posts. Bridges provide nesting places for English sparrows, pigeons, starlings, cliff swallows, phoebes, wrens, and robins. The Craighead brothers, ornithologists, then of Washington, D. C., found a duck hawk nesting on a bridge, the only recorded instance of its kind.

Back on the debit side, thousands of hawks and woodpeckers are shot from telephone poles by maintenance men and other armed transients. Nor are high-flying species immune. From aloft on a moonlit night the highway has a silvery sheen like the surface of a river. Migrating flocks of geese have landed on these roads, mistaking them for waterways. Some are killed or injured outright and others become victims of animals, people, and automobiles.

The extent and makeup of the highway kill of birds

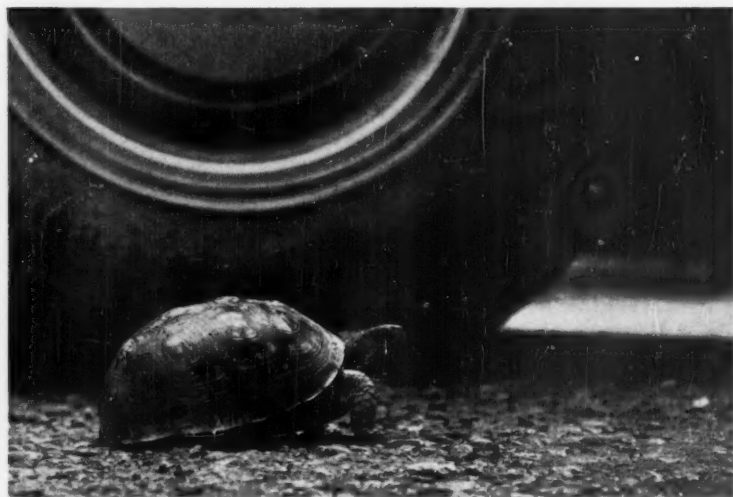


is almost an open subject. Dr. A. R. Shadle, who has studied the problem for many years, says that 87 percent of the birds crossing the highway fly in the "danger zone." James R. Simmons reports in his book, *Feathers and Fur on the Turnpike*, that the kill involves mostly males or immatures of most species, depending on the season and type of diet.

It is widely believed that the English sparrow's heyday vanished with the horse and buggy, but figures on this subject are surprisingly scarce. The automobile probably has reduced the number of house sparrows by replacing the horse and its entourage. The disappearance of stables, hay, and manure are reflected in the decline of this ubiquitous immigrant finch, although other factors undoubtedly contributed. Modern English sparrows, however, exploit collections of roasted insects on automobile radiators, and in this gleaning fill a new niche in the animal world — as well as a new position in automotive mechanics.

Although only the fringes of a unit of box turtle population would be intercepted by the usual grid system of roads, the turtles may die in large numbers. After spring rains in the mid-West they collect on the highways where many are killed in spite of the swerving efforts of most drivers to miss them. These "terrapins" are probably looking for a dry place, just as lizards and snakes seek the road's reflected warmth on spring days.

Ira Gabrielson writes that the horned lark is the greatest single victim of automobiles in



Box turtles are often seen crossing highways and many are crushed under the wheels of motor cars, while other motorists swerve to avoid hitting the dawdling pedestrians.

the western country. It is attracted to the roadside vegetation that results from the concentration of rainfall runoff. He says: "They congregate habitually here to feed, particularly in the late summer when things are still dry in the sagebrush and surrounding terrain and also where a heavy fall of snow has covered up temporarily the other available food supplies."

One January night during a blizzard my car struck a horned lark. Snow was piling up on the surrounding Kansas fields. The larks had discovered that the road was warm and were roosting there in small flocks. Apparently they circled back immediately after being flushed for they sometimes flew up shortly after another car had passed coming towards mine.

Another clique, the crows, coyotes, house cats, and foxes are attracted to highways as scavengers. Vultures also police the highways, although they seem to choose the quieter roads that have longer intervals between cars. The crow is especially efficient at this game, visits the roads early in the morning, and waits along the road for something to be hit — somewhat in the manner of a shyster lawyer.

These animal opportunists occasionally dally too long over a meal and go down before the wheels themselves. Such is often the fate of the house cat. In Missouri, conservation agents forward these bodies to a central laboratory where their stomachs are analyzed. Findings so far suggest that the cat may have been too widely condemned as a killer of birds. Their stomachs have contained mostly rodents and rabbits. The sample, of course, is biased in favor of cat-scavengers.

A number of other mammals head for the highways. Roadbed fills are perfect den sites for the groundhog, who both reproduces and dies beneath the turning wheels.

In some States the forests are cut, leaving strips of trees along each side of the highway for the sake of appearance. Thus, timber patches are bisected by a murderous line. The porcupine, whose diet is bark and whose pastime is rummaging around campsites, is attracted to these forested strips. He wanders across

the highway, sometimes only part way.

Wherever the fox is pursued by dogs in this country there seem to be a few smarties among them who use the road defensively. The bane of the hound owner, hillbilly or mounted red-coat, is the highway. Stories familiar to every hunter bespeak of foxes leading a pack of dogs back and forth across busy highways where they are killed. Sometimes the ruse backfires and the fox gets hit instead.

Examples are almost unlimited that would further serve our view that the highway is a magnet and producer as well as a killer. Together they underline one unanswered question: Is the wildlife housed and fed by roadside habitat equal to that destroyed by the automobile? If so, much of the highway kill is only incidental.

It is truly pointed out, however, that the kill could be reduced if drivers approaching visible wildlife would slow down. Most animals are not physically capable of escaping or even judging an object hurtling toward them at the speed of the modern automobile. Moreover, a majority of mammals are active only at night; these are befuddled, confused, and blinded by headlights.

While we are concerned with the highway toll, other aspects of highway ecology deserve more public attention. The sinister shadow of chemical poisons and flame-throwers for "control" of vegetation and "pests" is being cast over the highways of the whole country. Here is the real highway danger. The threat is directed toward essential food and cover. Perhaps our efforts should be directed against the specter of chemical warfare, rather than expended in vain wailing over the unavoidable.

In the meantime every driver in America is aware of wildlife's fiasco on the pavement, and these crumpled forms stimulate his sympathy and interest. These feelings can be cultivated toward an understanding of the ecological mosaic wherein we fit jointly with the traffic victims — victims that offer good focal points in the A B Cs of community living.

The Swans

By ALLEN E. WOODALL

We crossed the delta toward a shaft of light
Where the cloud-encompassed sun was slumbering,
And on the plain in shimmering black and white,
Thousands of water birds with shifting wing
Wheeled, turned and rested quietly from flight.
There were ducks and coots and gulls and herons there,
And the egrets' exclamation points of snow . . .
When suddenly a flight of cloud-white swans
Came swirling fanlike to the pond below,
And six great swans like a legend come to life
Flew through the moonstruck wonder of our gaze . . .
So beauty cuts with a quicksilver knife
Into the grayest hour of our days.

Bird Haven Now

By LELA CAMPBELL DOWELL

BIRD HAVEN, the sanctuary-arboretum-memorial of Robert Ridgway, internationally known ornithologist, has undergone definite changes in the past twenty-two years. To perpetuate the area, situated two miles north of Olney, Illinois, Dr. Ridgway, at his death in 1929, willed it to the University of Chicago. For the past several years it has been in a state of decline, and today the famed man's dream of its value to posterity is somewhat blighted.

At first it was Dr. Ridgway's plan to make a wildlife sanctuary out of the eighteen-acre wooded plot, and, since it was especially ideal for birds, it was given the name of Bird Haven. But when he found how rapidly trees grew there (the area had been under cultivation as late as 1872) and the great variety already growing, he decided to make it an arboretum as well. He thought of the advantage it would be to students to have all the varieties of woody trees, shrubs and vines of Illinois growing in one area.

But he did not stop with the woody plants of Illinois. The development of the arboretum became a sort of hobby with him. This collecting of plants became an exciting experience and soon he included "ornamentals, those of interest historically and others" from the United States and foreign countries. And while he was aware of the name of every plant, where it was planted, whether it was propagated from seeds or cuttings, and from whence it came, the planting was done by neither plan nor guide that those coming after him might follow.

His plan was, "if time was ever available," to label each specimen with a durable metal tag. These would correspond to a number in his cataloged book of plants,



Dr. Robert Ridgway, noted ornithologist, who willed Bird Haven to the University of Chicago when he died in 1929.

and on a selected specimen of each series would be stamped the vernacular and botanical names. This part of his work was never finished.

Consequently the 2006 plants, collected from far and wide and added to the 74 native species, are today unmarked. After Dr. Ridgway's death, fellow naturalists labeled them as best they could from knowledge and memory; but the metal tags were of material that soon deteriorated. It is believed that few of the imported plants are living today. Since all were planted together in the wooded area, the native plants would have a tendency to thrive better than the foreign ones.

Undergrowth has been allowed to grow unhampered, and tree limbs and trunks lie where they have fallen, tending to give the place an unsightly appearance. With each passing season, it becomes more of a sanctuary and less of an arboretum. It is said by those in authority that it was Dr. Ridgway's plan to have tree trunks and limbs left undisturbed that they might return naturally to earth. But pictures taken by him of the premises seem to contradict this fact, as they invariably present



A little stream runs through the area. Lack of funds and distance between the sanctuary and its owners make upkeep difficult.

The rustic bridge in Bird Haven. Even in winter the tangle that has grown up in this sanctuary-arboretum-memorial is evident.

a semblance of neatness with an absence of undergrowth.

According to bird students, at least five species of birds — the meadowlark, Baltimore oriole, Bachman's sparrow, blue grosbeak and redstart, which previously nested in the area, have disappeared. The absence of the meadowlark, of course, can be accounted for by the development of thick undergrowth.

For several years the little cottage where Dr. and Mrs. Ridgway spent so many happy days stood near the entrance gate, where it had been moved from the hill near the center of the area. It was furnished with lovely antiques, and, although unattended, beckoned all to pause and rest. There was a register to record the names of interested visitors. On the inside of the door, a notice in rhyme invited all to brew a cup of tea, the only stipulation being that they would replenish the stock on their next visit.

Many visitors took advantage of this novel idea and enjoyed the hospitality and hominess of the little cottage, which since has been sold and moved from the premises. At its former site on the hill — where Mrs. Ridgway's ashes were scattered — a pump and the remnants of an old, broken, sagging arbor covered with tangled vines are all that remain to indicate any trace of human habitation.

A few years ago Bird Haven was leased to a company for the purpose of drilling a test well for oil. A large area was cleared and the trees, shrubs and vines in the vicinity were destroyed by the activity accompanying this work. The well was dry and where once was a dense growth of trees are now a few old timbers and an ugly open plot of roughened ground.

The cause of the decline of Bird Haven may be attributed largely to a scarcity of funds, and its subsequent ills to the great distance between the sanctuary and its owners. The expense of building a new home for the caretaker to replace one destroyed by fire has exhausted much of the fund set aside for the sanctuary. Even before the winter of 1950-51 there was no money left to buy food for the birds. Fences needed repair and local nimrods slyly used the area for hunting.

Concerning the lack of funds, J. M. Beal of the Department of Botany of the University of Chicago, in a letter dated Sept. 19, 1950 wrote: "You may be aware



of the fact that the funds for the maintenance of Bird Haven are limited and that it has not been possible to do very much for that reason. Mrs. Petzel [Mrs. W. D. Petzel, the wife of a caretaker, continued living at Bird Haven five years after the death of her husband] was unable to do certain things and because of the scarcity of money could employ only a small amount of outside help.

"Of course, she could not repair fences and clear paths, but we are making an effort to obtain a man for the place. We need someone who can do those particular things, and it is our intention to secure such a person, if we can with the funds at our disposal. For many reasons, the University cannot divert funds from other sources to the care and maintenance of Bird Haven, and thus we are limited to the rather restricted amount available."

Of the distance between Bird Haven and the University of Chicago, an approximate 250 miles, Mr. Beal wrote: "The distance from us to Olney does not permit us to visit there very often, but some one of us usually gets down about once a year. It is not because of a lack of interest in Bird Haven and its purposes, that more is not done there, but it is the amount of money available which determines what can be done."

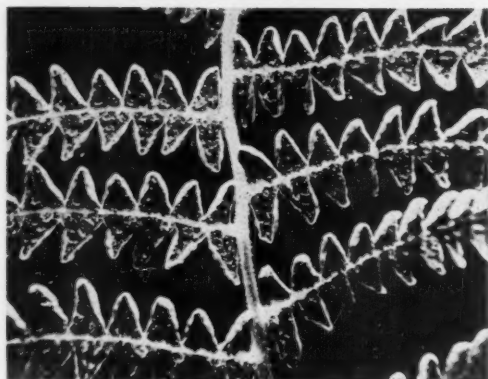
Thus Bird Haven is being forgotten. It has beauty, history and romance and is ideally located for its purposes. But under the existing conditions, it has no future. With a reasonable amount of money, the personal supervision of a few capable, interested people who would place more emphasis on the arboretum or garden side, it could be restored. It could even be self-supporting. Bird Haven still has great possibilities.



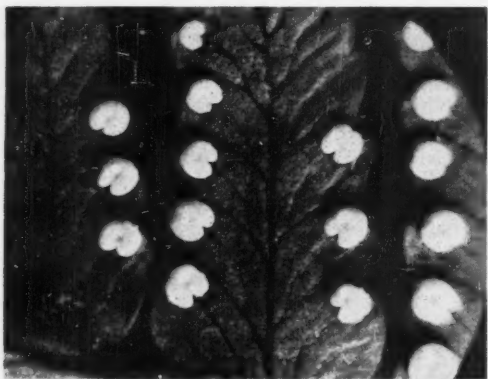
The Double Life of the Fern

By HUGH SPENCER

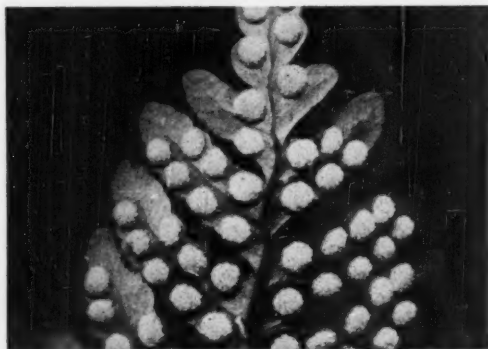
Photographs by the Author



Here we see the "snuff-box" pinnules of the marsh fern from the under side.



In the shield ferns, as well as in many other species, the sorus, when young, is protected by a thin covering called the indusium.



The sori of the common polypody fern, seen here, look like tiny pinecushions.

IF A mouse gave birth to a rabbit, and the rabbit subsequently produced a litter of mice, and this rotation continued successively, we would consider it a remarkable phenomenon. Yet a corresponding complexity, occurring regularly in the life cycles of ferns, as well as with some fern allies, make no headlines and is little known except to horticulturists and students of botany.

The familiar ferns of woodland and roadside are only one phase of a double life that botanists call Alternation of Generations. The other generation is as unlike our usual conception of a fern as an egg is unlike a chicken. The two entities in this dual existence bear the botanical names of *prothallium*, or *gametophyte* and *sporophyte*. The clusters of green fronds that are so much a part of our forest landscapes are the sporophyte stage of the fern's life. The prothallium stage seldom attains a size as large as one's little fingernail, is rarely seen, and would not be recognized as a part of the fern's cycle except by those familiar with the mysteries of fern life.

Ferns belong to a group of plants sometimes known as flowerless plants. They bear no true flowers and produce no seeds. Reproduction is chiefly by means of asexual spores borne on the sporophytes. These spores are microscopic in size and are really plant life reduced to its smallest unit — a single cell. A thousand of them placed side by side would make a row less than an inch in length. Yet somewhere in the tiny blob of protoplasm within the spore there is impressed the guiding influence that will shape the growth and behavior of the fern through its complete cycle and the cycles of hundreds of generations to follow. The germination of the spore, when it falls in a warm, moist place, produces the prothallium. This is the sexual generation of fern life and corresponds, in some ways, to the flowering stage in higher plants. No fruit or seed, however, or anything resembling fruit or seed, are here produced.

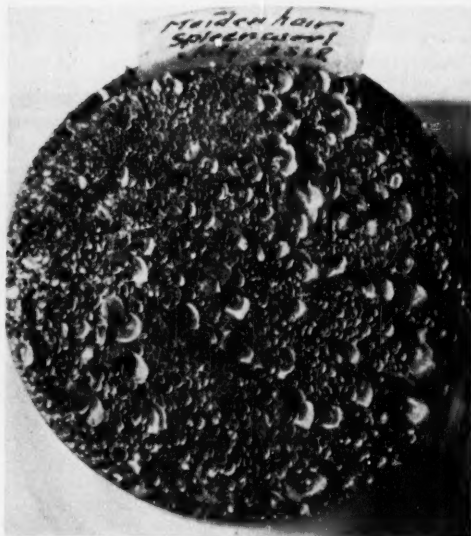
The development of a fern, like the growth of most living things, takes place by means of repeated cell division. The spark of living tissue that escapes from the spore shell divides to become two cells and grows by continued division of cells as it absorbs moisture from the earth and carbon dioxide from the air. The growth of the prothallium takes place in this manner over a period of weeks or months. At maturity it is usually a flat, heart-shaped blade, rarely more than a quarter of an inch in diameter and without roots or stem. On the undersurface it bears certain root-like filaments called *rhizoids*. These aid the plant in obtaining moisture and nourishment from the soil, and, at the same time, furnish support and anchorage of a sort. Also on

the underside there are two sorts of minute structures called *antheridia* and *archegonia*. These are sexual organs — male and female.

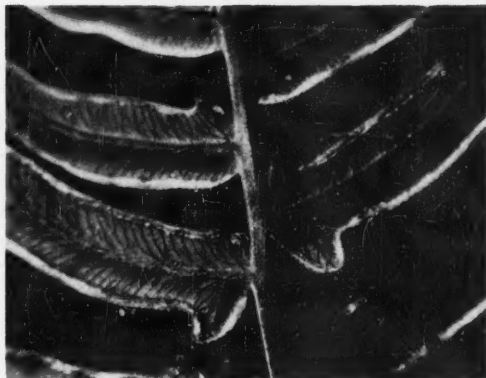
The antheridia are microscopic blisters arising near the basal region among the rhizoids, each containing, usually, 32 sperm cells. Near the apex of the prothallium, just under the notch, are the flask-like archegonia, each of which contains a single egg cell. We now begin to see that the pattern of reproduction in ferns is very similar to that of higher plants as well as in animal life — male and female, sperm and egg, reproduction through the union of two opposite sexes. Until such time as fertilization takes place, the prothallium may continue its existence as an entirely independent plant even up to several years, although it will grow but little in that time.

The tireless patience of the pioneer botanists who ferreted out the mystery of the fern's sex life inspires our admiration, for the reproductive structures are of such microscopic size that they can be studied only with high-power microscopes.

Let us assume that we have been given the power to observe the drama that takes place in this miniature world among the rhizoids. At a time when the under-surface of the prothallium is bathed in moisture, from rain or dew, the top of the antheridium opens and the sperms escape — swimming! Yes, plant cells that behave like protozoa, coiling and twisting, lashing with whip-like cilia, they make their way over the smooth wet surface until they reach the archegonia and slip in through the neck of the flask to unite with and fertilize the egg. It is believed that they are guided by some



A thousand or more prothallia in a two-inch plant pot two months after planting. A potential garden full of ferns can have their beginning in this way.



The sporangia of bracken are concealed under the rolled-back edges of the pinnules.



Fern prothallia being propagated under glass. Constant but not soggy moisture is essential.



The interrupted fern bears spherical sporangia on specialized pinnae of the fertile fronds.

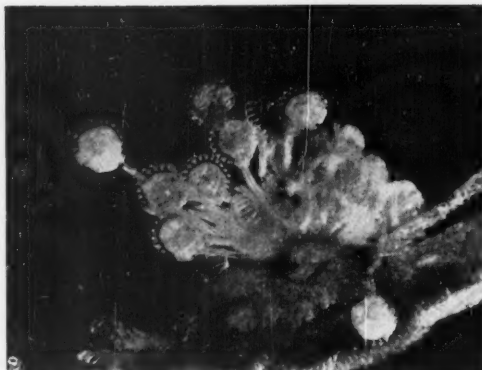
chemical reaction or stimulus. This is the beginning of the sporophyte generation.

The impact of sperm upon egg causes the latter to divide into two, and then four, sections, each of which by further growth will become a specialized part of the new plant. One of these parts will grow downward and become a true root, a second part reaches toward the light to become a leaf, a third division forms a bud, which will produce the underground stem, or rootstock, and from which additional leaves and roots will grow. The fourth quarter forms a unique organ called a foot, which remains attached to, and is parasitic upon, the prothallium. The new generation is born and the prothallium withers and dies. The sporophyte may, however, require several years before it is sufficiently matured to bear spores.

It can truly be said of ferns that "by their fruits ye shall know them," for it is by the shape and arrangement of the fruit-dots, or *sori*, on the fertile fronds, that many species are recognized and classified. Other species may be identified by their distinctive *sporophylls*. On these pages are shown photographs of the sori of several common species. They occur, usually, on the undersides of the leaves and can easily be seen with the naked eye, but their true nature can be studied only with the aid of a lens.

If we cut a thin slice of the leaf through the sorus and place it under a microscope we discover a cluster of *sporangia*. Each *sporangium* (spore case) consists of a stalked capsule containing, usually, 32 or 64 spores. It is significant that, although the sori of different species exhibit many external differences, the sporangia are, usually, so much alike as to be indistinguishable from each other. This is true of such widely different species as bracken, maidenhair, shield ferns, spleenworts, Christmas fern and many others. The individual sporangium, in most cases, is a paddle-shaped structure with the large end expanded to inclose the spores. The thin, broadly elliptical walls of the case are united at the edges by an elastic band so contrived that it will break at a certain point and the recoil will scatter the spores. Some species, such as the osmundas and the grape-ferns, have spherical sporangia that open up like split oranges. Estimates of the number of spores from a single plant run into millions. This profusion may continue, season after season, for many years.

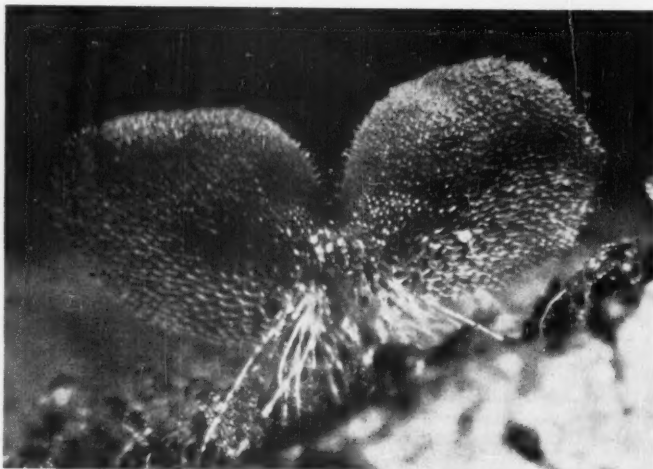
It would seem, with such a multitude of spores, that there would be prothallia springing up everywhere in moist woodlands, but such is rarely the case. To find prothallia growing in the wild is like hunting for the proverbial needle in a haystack. It is far easier to grow thousands of these little plants at home, or in the laboratory, than to find one in the field. If the reader



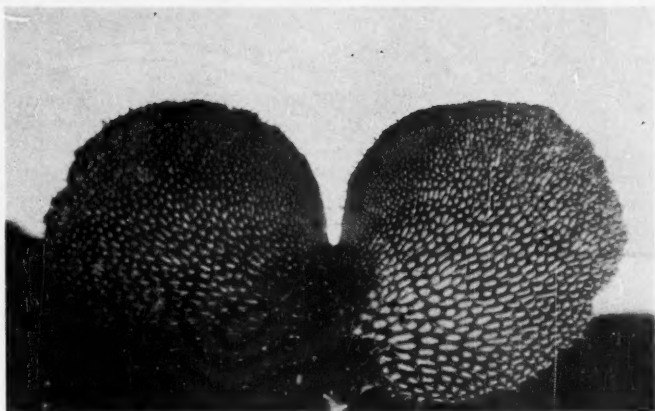
Sectioning through the sorus of the Christmas fern shows a few of the many sporangia. Each sporangium contains 32 or 64 spores. Magnification 50 times.



The brownish and crescent-shaped sori identify the lady fern. Below, under side of fern prothallium. Clustered just under the notch are the archegonia. The antheridia are hidden among the rhizoids or root-like filaments.



Fern prothallium — no root, no leaves, no stem, yet a living, growing plant. This is the gametophyte generation of the fern. It rarely attains a width in excess of a quarter of an inch.



now feels an irresistible desire for a first hand acquaintance with the fern's other life he will find it a simple matter to start his own miniature fern garden. The materials required are easily obtained.

Spores of one kind or another can be collected at almost any time of the year. Collect a mature spore-bearing frond and place it between two sheets of paper in a dry place. If the spores are ripe they will be discharged rapidly, and there should be an abundance by the following day, or at least within two or three days. The next step is to fill two or three small earthenware plant pots with rich loam and then sterilize them with steam or boiling water to destroy insects, fungi and other undesirable organisms. A few minutes in a steam pressure cooker is a good way to do it. When they have cooled, sift the spores thinly over the soil and then place each pot in a saucer of water and cover it with a tumbler, or several may be put in a tray under a bell glass. The important thing is to maintain constant moisture but not a soggy condition. A temperature near 65° Fahr. is best. Keep in a light but not sunny place, a north window is ideal. In two or three weeks the soil should show a greenish tinge, at six to eight weeks the characteristic prothallia shape will be in evidence, and within three or four months some first leaves of the sporophyte generation should appear.

In a state of Nature a million spores may perish for every one that survives to become a mature plant, but under more favorable conditions the percentage of germination is very high, and a large garden full of plants may have their origin in a small plant pot as here described. Both common as well as rare species may be grown in abundance, provided spores can be obtained. Of native ferns the grapeferns are the only ones, so far as I know, that do not respond readily to indoor culture. Spores will germinate and produce prothallia on old pieces of wood, bits of porous brick, or fragments of earthenware plant pots, if kept moist in a covered dish.

Where prothallia are desired for study under the microscope it is best to grow them in this way so as to have specimens free from sand and other coarse material.

An earthenware pot of two-inch diameter will sustain hundreds of prothallia in their early stages although, naturally, growth will be retarded if they are excessively crowded as they develop. If badly crowded they may be separated by lifting out small clusters with tweezers and transferring them to additional pots or trays. Further transplanting may be necessary from time to time after the first true leaves appear and the plants grow larger. By the end of a year the plants should have several leaves and be from one to four inches high. At this stage they may be transferred to wooden flats and placed outside, where they should be kept in the shade and well watered for several weeks before being put out in the open.

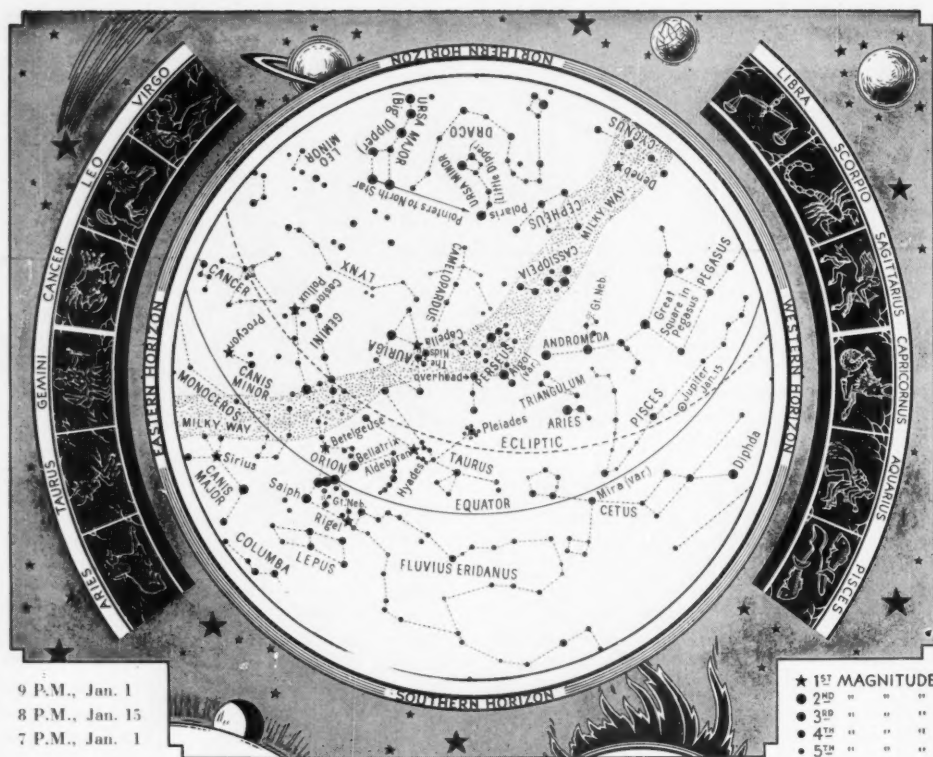
Such an experiment in fern culture could be a worthwhile project for any biology or botany class, or for the amateur horticulturist.

For those who wish to collect spores the following calendar may be helpful. Interrupted fern is one of the earliest to discharge its spores followed by cinnamon fern and royal fern. The approximate dates for the above are May 25th, May 30th and July 20th. Christmas fern, July 5th; marginal shield fern, July 30th; Polypody and maidenhair, Aug. 10th; Silvery spleenwort and maidenhair spleenwort, Aug. 15th; ebony spleenwort, Aug. 20. The erect sporophylls of sensitive fern and ostrich fern may be obtained during late fall and winter months and will usually yield plenty of ripe spores.

In Memoriam

By ELINOR HENRY BROWN

She walked this earth with leaf-mould on her shoes.
Where she has gone, I think she would not choose
The golden pavements, or harps in alabaster halls.
She treads a woodland path, and a vireo calls.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

The Heavens in 1952

By ISABEL M. LEWIS

DURING the year 1952 there should be a noticeable decrease in solar activity. The sunspot minimum and the beginning of a new sunspot cycle should occur late in 1954, or early in 1955. The last sunspot minimum was in 1944, and the following sunspot maximum, the most active on record since 1778, occurred in May of 1948. The average length of a sunspot cycle is about eleven years, although it is quite irregular and varies in length from seven to seventeen years.

At the time of a sunspot maximum ultraviolet radiations from the sun are greatest; the surface of the sun is never free of spottedness; magnetic storms and radio and telegraphic transmission are at times seriously disturbed, usually when some great sunspot group crosses the sun's central meridian; auroral displays are most intense; solar prominences are observed most frequently in association with sunspot areas; and the

solar corona has its characteristic sunspot maximum form, intensely bright and evenly developed in all solar latitudes. At sunspot maximum the general surface air temperature of the earth has been estimated to be about $1\frac{1}{2}$ degrees lower than at sunspot minimum.

As we approach the period of minimum solar activity the number of sunspot groups observed on any one day falls off frequently to two or three. There will be days now and then when the sun is entirely free of spots. There will be fewer magnetic storms; auroral displays will be fewer and reduced in intensity. The solar corona observed at time of a total solar eclipse will be then very different in form from that of the sunspot maximum type, showing long streamers at the solar equator and short bushy polar rays, parting sharply in opposite directions over the solar poles.

Sunspots rarely appear more than 45 degrees from the solar equator or exactly at the solar equator. They

usually occur in two belts north and south of the solar equator between solar latitudes 30 and 5 degrees.

At the sunspot maximum period sunspots occur in greatest numbers at latitudes 15 to 20 degrees from the equator. As the minimum sunspot period approaches, even two years or so before, a few small spots of a new cycle appear occasionally in higher solar latitudes even as the spots of the old cycle are passing out within 5 degrees or so of the equator. Those are the conditions that may be expected this year when a few spots of a new cycle may appear. There should be also a marked decrease in ultraviolet radiation from the sun, and a general decrease in all forms of solar activity associated with sunspots and their effect upon the earth.

There will be four eclipses this year two partial eclipses of the moon, and a total, and annular, eclipse of the sun.

The partial eclipse of the moon, which will occur on February 10 in Eastern Standard Time, will be small, less than a tenth of the moon's diameter being covered by the earth's shadow at greatest eclipse. It will be visible at Washington, D.C., and, generally, in Asia, Europe, Africa and most of North and South America.

The total solar eclipse that will occur on February 25 will be a large and important one and an outstanding astronomical event. Plans have been made by a number of scientific observers to be in the path of the total phase of the eclipse, where the duration of totality will be 87 seconds on the central line near sunrise, 189 seconds at a maximum near noon, and about 92 seconds near sunset. The path of total eclipse will touch the earth first at sunrise in the Atlantic Ocean at the equator, in longitude about 21 degrees west of Greenwich. It will touch the coast of Africa at Libreville, and from there cross that continent in a northeasterly direction to the Red Sea at Port Sudan, passing over Bangui in French Equatorial Africa, and the Anglo-Egyptian Sudan. Khartoum, on the Nile, has been considered one of the most favorable places for the observation of the total eclipse, as it occurs there near noon with a duration close to 189 seconds.

After crossing the Red Sea the path of the total eclipse crosses Saudi Arabia to Basra on the Persian Gulf, over the Plateau of Iran to the southeast coast of the Caspian Sea, over Khiva, in Turkestan, into Siberia, where it leaves the earth at sunset. Partial phases of this eclipse will be visible over all of Africa, except the extreme southern part, all of Europe, and all of Asia except the eastern and southeastern parts.

The partial eclipse of the moon that will occur on August 5 will have a magnitude of 54 hundredths, which is the part of the moon's diameter that will be covered by the earth's shadow at greatest eclipse. It

will be invisible at Washington, D.C., but visible, generally, in Australia, Antarctica, Asia, Europe, and Africa, and the eastern part of South America.

On August 20 there will be an annular eclipse of the sun, visible as a partial eclipse of greater or less magnitude over all of South America, the West Indies, and Central America. The path of the annular phase, which has a maximum duration around noon of 6 minutes, 41 seconds, starts at sunrise in the southeast Pacific and reaches the west coast of South America in

Peru, passing over Lima late in the morning. It then crosses South America in a southeasterly direction, passing over La Paz and Potosi in Bolivia, Resistencia, in Argentina, and reaching the east coast near Montevideo, in Uruguay, early in the afternoon. It leaves the earth at sunset in the Antarctic regions.

During 1952, the planet Mercury will be best placed for observation in the evening sky around the times of its greatest eastern elongations, which will occur on March 18, July 15, and November 9. The most favorable of these will be the one in March. The planet will be at greatest western elongation, when it may be looked for in the morning sky, on January 6, May 3,

August 29 and December 18. The most favorable of these will be the one that occurs on August 29. The planet should be looked for about ten days before and after the greatest elongations.

Venus starts the year in the morning sky, conspicuous in the southeast before sunrise. It will remain in the morning sky until it comes into superior conjunction with the sun on June 24 and passes to the evening sky. Up to this date it will appear nearer the eastern horizon each month until shortly before superior conjunction with the sun, when it is lost to view in its rays. It will next be seen low in the west after sunset. Its position will gradually improve for the rest of the year where it will be a brilliant object in the evening sky; but it will not arrive at greatest eastern elongation in 1952. Venus will be seen telescopically only in the phase of the gibbous moon in 1952, as it begins the year after greatest western elongation and ends it before greatest eastern elongation.

Mercury and Venus will be in conjunction three times in 1952, on April 16, June 4, and August 4. Mercury will also be in conjunction with Jupiter on May 16, and Saturn on October 3. Venus will be in conjunction with Jupiter on May 5, and Saturn September 15.

Mars starts the year in Virgo, rising shortly after midnight and as bright as a star of first magnitude. On January 21 it will be visible the second half of the night, rising at midnight. After that the planet rises before midnight, earlier each night, until, on the date of opposition to the sun, (Continued on page 50)

Stars in a Well

By DANIEL SMYTHE

Lost in this quiet, one looks down
To see a ring of star on star.
A space is mirrored here, a crown
Of night where deeper systems are.

A single sand upon a shore
With planet, sun and meteorite,
It bears intelligence before
The endless fall of years of light.

Wait for a moment; grasp a hand,
And stars out from this tiny well.
Star upon star in regions stand:
A bit of dust finds voice to tell.

The School Page

By E. LAURENCE PALMER

Professor of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

DOGS IN SCHOOL

IT MAY have been "against the rule" for Mary to take her lamb to school, but any such rule against dogs is probably violated by dogs and youngsters from one end of the land to the other. In not a few cases the dogs even enter the classroom, and I can testify to that from kindergarten to the university graduate school. We have, then, a situation present in most of the scholastic training period. What are we doing about it?

Since this page is designed to be of help primarily below the collegiate level we will stick to the precollege years. We will ignore the contributions dogs make to the decorum of university lectures, and the controversies their presence arouses in medical college laboratories. We will even ignore the contribution of dogs to great intercollegiate athletic contests.

We can list here only a few of many suggestions for using dogs in a school program. They lend themselves readily to stimulating the study of geography. In the special insert on pages 25 to 32 of this issue of the magazine you will find discussions of breeds that originated in Norway, England, Germany, France, China, United States, Central America, Italy, Ireland, Scotland, Spain, Newfoundland, Russia and Egypt. Reference to the supplementary books suggested should show that there are few parts of the world that cannot lay legitimate claim to the development of some breed of dog. In view of this why not conduct a dog census of the canines of the community based on the geographical origin of the breeds represented. Of course there will be many animals of a decided cosmopolitan nature, animals whose ancestry no one can tell. In spite of this the value of these animals may be worthy of consideration, and may be in excess of that of some whose genetics may be thoroughly documented.

Another survey might be well made of the types of service for which the dogs of the neighborhood are most suited — work of the draft type, work dependent on special senses of seeing, hearing, smelling, or obeying commands, or simply supplying companionship or protection.

History may be enriched by studying the activities of man that have been affected by dogs. A huge St. Bernard used to churn the butter on one of my ancestral farms. Now the power needed comes from increased engineering developments. Men have become more humane as the years have passed, and bull baiting, pit fighting and the like are no longer looked upon with favor. Wars have brought out new needs that dogs have been able to meet, and in spite of all that man can do it is doubtful if there will ever be a human society in which dogs will not find their place. What changes in this category have taken place in your community since the school was built?

There are social problems with which dogs are identified, and on which we must all be prepared to pass intelligent judgment. Can the rights of the individual dog or citizen be protected if they are interfering with the rights of the community? When is a dog a menace to the neighborhood, and can an individual take the situation into his own hands and solve it as he sees best? What about killing dogs by shooting them, or by poisoning them, if they have a demonstrated dangerous career? What can one do to a trapper whose trap maims or kills a valuable dog? What about a dog that destroys sheep, gardens, clothing, or anything else? Surely there are some nice bits of judgment involved in settling some of these questions in a social science class. We do not presume here to enter the lists raised by the humane societies

and the anti-vivisectionists, but the problems involved in dog experimentation are dynamic, to say the least.

Most dog owners are sure that their dog has qualities superior to most others. Why not set the stage so that these qualities may be demonstrated? It may develop that children can appreciate that while one dog can run faster than another it may not pull a load so well, follow a trail so effectively, enter a burrow with equal ease, or provide protection similarly. A chihuahua is not likely to rescue a drowning person by direct action, but he may rouse a family in a sleeping household. List the gifts that make dogs useful to man, and then set up some way of demonstrating the ability of the neighborhood dogs. In a city and in the country the skills needed will vary and the breeds of dog present will probably vary accordingly. Frequently humans misunderstand the qualities possessed by dogs. I shall never forget the neighborhood boys who came from seeing the movie "The Call of the Wild." They immediately hitched a fox terrier to a cart, all piled into the vehicle and yelled "Mush." I have often wished I could have interpreted the answer the dog seemed trying to give to the command.

Any reasonable investigation of the abilities of the dogs of a neighborhood may raise the question of whether the most is being made of those qualities. In this connection I cannot recommend too highly a favorable consideration of the movement associated with obedience trials. If there is a group interested in this thing in the community, the school should be identified with it. It does not require the use of dogs with established pedigrees. It just seeks to improve the relationships between man and dog, and anyone who has watched a group at work over a period of time must admit that it gets results. Dog shows in which breeds are exhibited and are recognized are all right, but they are necessarily limited to dogs that in one sense must be considered social snobs. The obedience classes are strictly democratic, and the membership in these classes brings together persons whose greatest binding force is their interest in their pets. Differences in wealth, social standing, professional reputation are forgotten when a representative bunch of dogs of all breeds, sizes, ages, sexes and dispositions are lined up in those competitions. Pride and exasperation, disappointment and joy are only a few of the emotions that get opportunity for expression in an obedience test. If you have never seen one you have missed something. If you have never taken part you have a future full of opportunity.

I think that one of the satisfying experiences of working with dogs is the study of the way they adjust themselves to the lives they must live. While they must of necessity accept something from man, most dogs still maintain a considerable degree of independence. The world is full of problems bearing on the adjustments that must be made between dependence and independence. There are rugged individualists in the dog world, just as there are individuals always looking for a handout. It might be enlightening to some to observe that total dependence rarely develops superior character, that, while men and dogs seek independence and freedom, there is no such thing as complete freedom and never should be. It is gratifying to compare dogs with men sometimes and to notice frequently the joy some dogs get from serving without thought of reward. Surely, some take whatever they can get and may get fat on it, but, honestly now, who would choose as the dog of the week in your community a fat, lazy, pampered, apartment-confined animal in contrast with a sleek, alert, virile animal, on his toes to win a competition with his peers, or an animal whose devotion to some person shows in every action — an animal like our Tiddley whose heart was broken if we said a harsh word to him and whose brows were frequently puckered in concern because he just could not determine what was wanted of him. If one wants to see joy expressed in its completest form I do not know where you can find it better than in a dog that has done a good piece of work and has received what is to him the greatest possible accolade — a good word from those with whom he finds his lot cast.

Environment and Health

Environment and Health. Washington, D. C. 1951. U.S. Public Health Service. 152 pages. Illustrated. Available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. \$.75.

That the health of the nation and its people depends largely upon the environment in which they live should be obvious. That environment can be and is wrongly affected by man at the expense of health is likewise obvious. Stream pollution is a case in point, and an important chapter in this book discusses this problem in straight-forward fashion. Indeed, there is a great deal of conservation in this book, much of it more implied than expressed. However, the popularly presented and graphically illustrated discussion of an important and basic question affecting the lives of all will open many eyes to the problems involved in the field of environmental health.

Poems of Birds

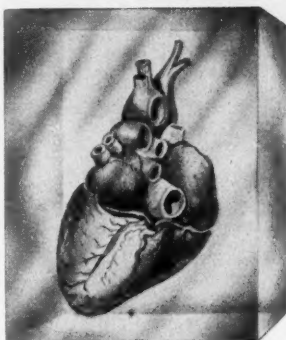
In Time of Swallows. By Mae Winkler Goodman. New York. 1951. Devin-Adair Company. 54 pages. Illustrated by William E. Scheele and with a foreword by Kenton Kilmer. \$.75.

From time to time this poet's charming poems have appeared in the pages of *Nature Magazine*, as they have in a number of other publications. Some of these poems have been about birds, for the poet is an active member of the Cleveland Bird Club. In this attractive little book she has gathered poems about 52 birds, and she has enlisted the collaboration of Mr. Scheele, Director of the Cleveland Museum of Natural History, to provide delightful illustrations to accompany the poems. Thus we have a book of poetry that is more than just poetry. It is a splendid book to use as a gift for a bird-loving friend, or to a poetry-loving bird enthusiast, or just to someone who enjoys good poetry.

Gardening Filmstrips

Two years ago Impco, Inc., was organized at 1050 Boulevard, New Milford, New Jersey, to produce material of interest to families, adults and children, relating to experiences based upon the land. An extensive program on conservation subjects is projected. One series of six filmstrips entitled "Family Gardening" has been brought out as a basic approach to the program. The titles in the series are Soil Preparation, Planting, and Growing, Harvesting and Use, Preserving and Storing, Some Special Garden Problems, and What is Family Gardening? Further information about these filmstrips may be obtained at the address given above.

PLASTICAST



FOR PERMANENT PRESERVATION OF BIOLOGICAL SPECIMENS

PLASTICAST is a transparent clear liquid plastic (refractive index, 1.5). All forms of biological life, sections or whole small creatures, as well as organs can easily and quickly be PRESERVED FOREVER without deteriorating simply by imbedding in PLASTICAST. The entire process is as easy as pouring water out of a glass and takes less than 30 minutes! A few drops of catalyst are added to the liquid plastic before imbedding. The liquid plastic turns into a hard glass-like solid without heat in 10 to 15 minutes! Ideal for biological work of all kinds. Price per gallon (including catalyst and complete directions), postpaid, \$17.50.

Trial pint (including catalyst), postpaid... \$3.00

PLASTICAST COMPANY

P. O. Box 987, Dept. A-21

Palo Alto, Calif.

Explore Our Universe

Why do stars twinkle? Who named the Milky Way? Where do comets go? How hot is a star?

THE HEAVENS ARE TELLING, The Story of the Sky, by Urana Clarke answers these and hundreds more questions asked by young would-be astronomers. 34 chapters of the book cover solar system, planets, time, constellations, meteors, guide lines, etc. 14 photographs and 48 striking drawings. 6 x 9. 128 pages. Colored end-papers. Hard bound. A wealth of information for only \$2.95.

"Springily and understandable... should introduce many readers (not all of them young!) intimately and accurately to the thrilling realm of the starry heavens." — Dr. Helen Sawyer Hogg, Research Associate, David Dunlap Observatory.

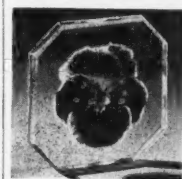
Send check or money order for \$2.95 to Acorn House, Dept. N, P.O. Box 84, Riverdale 71, N. Y. Unconditional money-back guarantee.

\$532 for a day in the SHAKESPEARE Country

Including train from London, motor tour, luncheon and admission fees! Everywhere in Britain you'll find amazing travel bargains such as this.

BEFORE YOU LEAVE, obtain assured reservations on trains, tours, channel steamers and at any of the 41 hotels of The Hotels Executive. PLEASE CONSULT YOUR TRAVEL AGENT or write Dept. G-28:

NEW YORK 20, N. Y.
9 Rockefeller Plaza
CHICAGO 3, ILL.
37 So. La Salle Street
LOS ANGELES 14, CAL.
510 W. 4th Street
TORONTO, ONT.
69 Yonge Street



REAL PANSY COASTERS

Now create new and truly different gift articles like the beautiful pansy coaster shown — made by embedding real pansies in Castolite — the "magic" liquid casting plastic. With our simple step-by-step method you can make hundreds of valuable articles, including smart costume jewelry, chic Hi-Style buttons, colorful key tags, tie-clasps, cuff links, plaques, tiles, many other things. Send 25c for Big Castolite Creations Manual. FREE with Manual, inspiring New Home-Success Plan. Write:

CASTOLITE CO., Dept. A-28, Woodstock, Ill.

EVERYBODY LOVES A Scott Lawn

Because they have a certain sparkling beauty all their own. Here's the first step toward having a Scott Lawn. Read Lawn Care—it's a free, five times yearly bulletin service designed for home owners like yourself. In simple language it tells you what to do, when and above all HOW. Write today for your free two-year subscription. Don't miss the next issue especially. Just address O M Scott & SONS CO., 14 Maple street, Marysville, Ohio, and say—Send me Lawn Care.

Mention NATURE MAGAZINE when answering advertisements

Camera Trails

By
EDNA HOFFMAN EVANS

IT IS odd how things that are uncommon or rare in our particular environments seem to us to be quite wonderful. We cherish and care for them in a way that far exceeds the merit of their actual worth. Such actions are amusing to people who see these things every day.

For example, my western friends "Oh" and "Ah" in admiration because I use some Florida cockle shells as ash trays. They handle those shells with great care — in fact, they are almost afraid to stamp out a cigaret in one of them. Such actions amuse me because I picked those shells up one day when the beach was almost covered with them.

On the other hand, the westerners laugh at me when I pick up rocks and pebbles. Rocks are just rocks to them (unless, of course, there happens to be a gold nugget embedded in one). So you see, it all depends on one's point of view. Rocks are as much of a curiosity to Florida-bred me as big cockle shells are to my inland cronies.

The same is true with snow. For years I lived where snow was non-existent. Even today, when I can reach snow by driving about a hundred miles and gaining a couple thousand feet in altitude, snow is something to marvel at. My friends, however, with not-so-pleasant memories of frozen radiators, icy roads, and snow shovel duties, do not share my enthusiasm regarding snow.

It was not so long ago that I managed to reach the snow country and actually experience the sensations that come from contact with the white stuff. The sun was shining and the weather was not nearly as cold as I had expected. The white covering, some hours old by the time I saw it, masked out any harshnesses that there might have been in the landscape. Even the sharp edges of the rocks were smoothed and softened by the white coating.

There was nothing harsh or repellant about the landscape. It looked pleasant, clean, and inviting — much softer and kinder even than dunes of white sand on the beach.

I was surprised — even a little shocked — when I stepped into a snowdrift and felt the sharp cold of it through the thick wool socks on my feet. Beach sand certainly never felt like that.

As for photography — which was the chief reason for my trip into the snow country — there both were and were not great possibilities.

I am sure that some "Camera Trails"



Tracks in the snow provide a center of interest for the eye to fix on.

readers, who have been shoveling snow and plowing through drifts for the last two or three months, will think this discourse is quite silly. If so, just imagine how thrilled you would be to step outside and see a growing palm tree or a blooming rose bush at this instant. You would reach for your camera, too.

I have never been fortunate enough to wake up in the morning to find the world shrouded in snow. I have never seen pine, spruce, or cedar trees wearing a coat of white over their everyday dress of green. I have never seen a crust of ice so thick that it breaks tree branches and pulls down wires. I have never seen drifts so high that housetops seem to be peeping out from under a soft blanket of down.

Never having seen such sights, I never have had the opportunity to photograph

them. But, from my brief excursions into snow land, I have learned certain definite techniques that must be considered in taking snow pictures.

In the first place, shadows are important. It is necessary to have them, otherwise a snow picture appears flat and uninteresting. This being the case, sunlight is virtually a "must" for snow pictures. There are exceptions, of course. Sometimes trees, shrubs, rocks, or other dark objects provide contrast. Still, shadows help even then to provide intermediate gray tones between the white of the snow and the near-black of the other objects.

Morning or afternoon is the best time for shadows. Watch for the long diagonal ones, and for the kind that give depth and distinctness to shallow surface depressions. These latter are the kind that bring out footprints across a smooth snow surface.

Snowscapes, like landscapes, are best when there is a definite center of interest. I learned this by experience, too. At first I was so intrigued by the long expanses of white that I just aimed at infinity and shot pictures. The results — well, there was just nothing in them to look at. The same was true when I aimed the lens at snow foreground and forest background. Half the picture was white and the other half was black, with few if any details to break the monotony.

The best pictures from the expedition, I think, are those with a definite center of interest — the footprints of a rabbit across a snow-whitened slope, or the long shadows cast by tree trunks in the afternoon sun. There is something to look at in those pictures; something the eyes can focus on and the brain can think about.

The same is true with color shots. In color, of course, one can get greater variety and interest because color values are not reduced to tones ranging from black to white. There is a great deal of blue in the shadows, as is usually the case when the sky is blue. I like this blue tone and



Even the sharp edges of the rocks are smoothed and softened by the white coating.

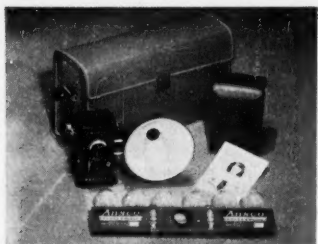
I do not particularly wish to avoid it. If, however, the photographer wants less blue in his shadows, a colorless, so-called skylight or ultraviolet filter may be used. These are the same filters that are used to cut down the bluish cast often found in landscapes, marine, or high altitude shots.

Filters also can be used to good advantage in black-and-white pictures. They tend to intensify shadows and to give particularly dramatic results.

There are a number of filter possibilities for snow scenes. A light yellow filter is a good all-purpose one. It serves to darken the sky a little and to give greater emphasis to shadows. A pale green filter does much the same, and it also helps give a more pleasing rendition to close-ups of faces. An orange filter gives greater emphasis but operates along lines similar to that of the yellow filter.

The greatest variation and most desirable results can be obtained with the use of a red filter. Clouds stand out sharply against a black sky, and all shadows in the snow are sharply and clearly defined. You may lose some detail in foliage, but this is more than compensated for in the details you gain in shadows and sky.

Of course, when you use a filter, you must remember about that all important "filter-factor." That is, the increase in



The Anso Rediflex camera outfit includes camera, case, batteries, flash-lamps, portrait attachment, two rolls of film and a gadget bag.

amount of exposure time necessary because of the decrease in intensity of light passing through the camera lens. Each filter has its own factor and is calibrated accordingly. Generally speaking, a light yellow filter requires one extra lens stop opening, while a red one may need as much as three or four.

As for time and exposure, snow pictures are tricky because of the reflection from an expanse of white. An exposure meter, properly used, is of great assistance here. Lacking this, the photographer can usually depend on a lens stop of $f/8$ at $1/50$ sec. for color pictures on clear, sunny days. With black-and-white film, depending on the type, exposures should rarely be less than $1/50$ sec. at $f/16$, opening up to $f/11$ for close-by objects.

Special care for camera and equipment is necessary on winter photographing expeditions. The lens must be protected from snow. Where there is a rapid change

in temperature — from warm indoors to cold outdoors — moisture may condense on the lens. This should be wiped away or allowed to evaporate before pictures are taken. Since snow is wet, and since moisture is not good for equipment, cameras, cases, attachments and the like should be protected as much as possible, and should be thoroughly cleaned and dried when the expedition is over.

At times when the weather is extremely cold — far below zero — care must be taken to keep moving parts from freezing, and to see that film made brittle by cold does not snap. I have never known cold like that, and I do not think I am particularly anxious to make its acquaintance.



The Kodak Pony Camera outfit offers a great deal of useful equipment for the beginner who is starting from scratch.

NEW CAMERAS

ANSCO has announced the addition of five new cameras to its line. Four of them are reasonably priced (under \$50) and the fifth, the 35mm Anso Karomat, sells for \$168.50. The four lower-priced cameras, designed for amateur use, are the Anso Speedex Special; the Anso $f/4.5$ Speedex; the Anso $f/4.5$ Viking, and the Anso $f/6.3$ Viking. All five cameras are made in Munich, in the U. S. occupied zone. Full information may be obtained from your camera dealer, or direct from Anso, Binghamton, N. Y.

Eastman also has a new camera, the Kodak Retina IIa, a 35mm camera priced at \$168.50. It has a Schneider Xenon $f/2.0$ lens, a synchro compur shutter with speeds up to $1/500$ sec., built-in flash synchronization, and a superimposed image-type range finder.

COMPLETE OUTFITS

BOTH Eastman and Anso also have prepared complete outfits for the amateur who is starting from scratch. Anso has three different outfits, priced at \$15.95, \$24.95, and \$26.95. Included are such items as camera (this varies depending on price), portrait attachment, flash synchronization, flash equipment (including bulbs), camera case, gadget bag, and film.

Eastman's kit, priced at \$55, includes the Kodak Pony 828 camera, case, flash equipment, and one roll of color and one

"An excellent book" AMERICAN WILDLIFE AND PLANTS ALEXANDER

C. MARTIN • HERBERT S. ZIM
ARNOLD L. NELSON

"Carefully organized, well-documented . . . It is an authoritative reference and should be in the library of every student of natural history." — **PROF. HAROLD E. ANTHONY**, *The Amer. Museum of Nat. Hist.* "An amazing amount of information packed into one volume . . . a basic reference work for every man working in the wildlife field." — **IRA N. GABRIELSON**, President, *Wildlife Management Institute*. "Enlightening and valuable . . . It is a treasured addition to my library." — **JOHN KIERAN**. With 700 line drawings, diagrams and maps; plus a thorough index.

At all bookstores \$7.50

McGRAW-HILL
BOOK CO., Inc.

330 West 42nd St., N. Y. 18

Do You Want to Know . . . THE SECRETS OF RELIGION DOWN THROUGH THE AGES

In this day and age we should know the ancient fallacies in religion and have modern scientific foundations. . . . Mail this clipping and one dollar for "In Search of Truth," a startling and enlightening booklet on religion by Dr. Russell F. Egner, author of "The Secrets of Religion Down Through the Ages." Address:

THE RELIGIOUS GENERATIONS
FOUNDATION
5008 Oliver Ave. So.
Minneapolis 19, Minn.

AMAZING WONDER LEAF OF THE TROPICS

A botanical novelty that grows and multiplies either potted or suspended in air or simply pinned to a curtain, screen, mantle, woodwork, etc. Send 35c for one leaf. 4 for \$1 postpaid.

H. KINGSLEY, 312 N.E. 13 Ave., Ft. Lauderdale, Fla.

AMAZING NEW TRAP!



Trap for fun, profit, or rodent riddance. Guaranteed HAVAHART trap catches them alive, protects pelts. No springs or jaws. Rustproof. Sizes for all needs. For free booklet, mail coupon today.

HAVAHART, 44-J Water St., Ossining, N.Y.

Please let me in on your trapping secrets.
Name _____
Address _____

roll of black-and-white film.

All four outfits would make excellent gifts, and the price range fits a variety of pocketbooks.



The new Kodak Retina IIA camera is offered by Eastman.

NEW BOOK

A BOOK that should be helpful to the amateur photographer is "How to Make Good Pictures," published by the Eastman Kodak Company. The book is not exactly new, but newly off the press is the twenty-ninth edition of a guide that was first published in 1912. Since 1926, more than two million copies of the various editions have been sold. The book is divided into four main fields — the what, why, and how of photography in general; getting down to cases on specific types of photography; light in the darkroom, dealing with techniques of developing, printing, and enlarging; and put your snaps to work. The book ends with a general index and a glossary of photo terms. That is a lot of information to get for a dollar.

THE HEAVENS IN 1952

(Continued from page 45)

which occurs on April 30, it will be above the horizon all night. After that date it rises before sunset and gradually passes over into the western sky. It will be on the meridian at sunset on August 16, and will end the year in the western evening sky. This will be neither a close opposition or a very distant opposition of Mars. When nearest the earth, on May 8, it will be a little under 52,000,000 miles from the earth.

Jupiter will begin 1952 in the constellation of Pisces, where it will remain until near the end of April. Then it will pass into Aries, where it will be found until the end of the year. Jupiter will be conspicuous in the evening sky, where it has been for some time, into the early spring. It will be lost in the rays of the setting sun in April and will be in conjunction with the sun on April 17. At that time it passes to the morning sky, and in several weeks will be seen low in the east before sunrise. It will remain in the morning sky throughout the spring and summer until on August 12, it rises at midnight and is on the meridian at sunrise. After that date Jupiter rises before midnight,

earlier each evening until at opposition with the sun on November 8 it will be visible all night. From then on for the remainder of the year it will appear higher in the eastern sky at sunset on each successive evening, in Aries.

Saturn will remain in the constellation of Virgo throughout 1952. On January 5 it will be on the meridian at sunrise, rising at midnight. It will be in opposition to the sun and visible all night on April 1. From then on, until shortly before conjunction with the sun on October 11, when it will be low in the west and lost in the rays of the setting sun, Saturn will be seen in the evening sky. On June 30 Saturn is on the meridian at sunset and will set at midnight. After conjunction with the sun Saturn will be found in the morning sky and will be there at the end of 1952.

PLUTONIAN POWER PLANT

(Continued from page 16)

the hard, thin crust of the globe on which he lives, still remains an unsolved mystery to him!

But, just like a man, he digs and strains to lift great dams across the rivers of the world in order to harness the power of falling water. He toils and sweats and burrows in the dark depths of the earth for the coal he shovels into the hungry maws of his giant furnaces. He searches, probes and pierces the crusty hide of Mother Earth to withdraw barrels of black, ill-smelling oil. All this he does to provide power for his mighty machines, to produce heat and light, while beneath his very feet lies, untapped, perpetual power in quantities so prodigious that, in comparison, all his dams, all his furnaces, all his mechanical monsters combined are puny in comparison.

Pollution Bulletins

No conservation library with a section dealing with the vital problem of water pollution would be complete without the first five publications in the Water Pollution Series issued by the Public Health Service of the Federal Security Agency. No. 1 in the series is "Water Pollution in the United States," a dramatic, largely pictorial summary of the general situation that confronts us. This and the others to be listed are available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. The price of No. 1 is 35 cents. No. 2 is the first of four cooperative State-Federal reports on water pollution. It is entitled "Tennessee River Drainage Basin," No. 3 bears the title "Missouri River Drainage Basin"; No. 4, "Great Basin Drainage Basin"; No. 5, "California Drainage Basins." All of these last four present a basic picture of the pollution problem in the regions indicated and point to the task yet to be performed.

Forests Booklets

Five booklets issued by the U.S. Forest Service are of special regional value and we list them here in the conviction that no few people will wish them. First is "Southwestern Trees; A Guide to the Native Species of New Mexico and Arizona," written by Elbert L. Little, Jr., issued as Agriculture Handbook No. 9 and available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. for 30 cents. Second is "Pocket Guide to Alaska Trees" by Raymond F. Taylor and Elbert L. Little, Jr., issued as Agriculture Handbook No. 5, and available for 25 cents. Third is Yearbook Separate No. 2156 entitled "To Know the Trees" and dealing with the important forest trees of the United States. It is available for 15 cents. Yearbook Separate No. 2157 is entitled "Fifty Trees from Foreign Lands" and is available for 10 cents. Finally, "Key to Southwestern Trees" is Research Report No. 8 by Elbert L. Little, Jr., a more technical key to trees of the area.

Refuge Bibliography

Since the establishment of Pelican Island Reservation in Florida in 1903, more than 280 wildlife refuges have been created. Through the years, of course, a great deal has been published about these areas. Now Philip A. DuMont, biologist with the Branch of Wildlife Refuges of the U.S. Fish and Wildlife Service, has done a great service in compiling a "National Wildlife Refuge Bibliography." This is published as Wildlife Leaflet 334 of the Service, and is available from the U.S. Fish and Wildlife Service, Department of the Interior, Washington 25, D.C.

Salter Replaces Bennett

Dr. Robert M. Salter, Chief of the U.S. Bureau of Plant Industry, Soils and Agricultural Engineering since 1942, has been appointed Chief of the U.S. Soil Conservation Service to succeed Dr. Hugh H. Bennett, who has been appointed a Special Assistant to the Secretary of Agriculture. Dr. Bennett had been Chief of the Service since its creation in 1935, and a soil conservation missionary long before that. Dr. Salter has been intimately connected with soil conservation for more than a quarter of a century and has been an outstanding administrator, as well as a noted scientist.

Poison Ivy

We do not believe that we have before called attention to the excellent bulletin on "Poison Ivy and Poison Sumac" written by Dr. William M. Harlow of the New York State College of Forestry at Syracuse University, and, if we have, it will do no harm to repeat ourselves. Individual copies are available free from the Extension Department of the College, and five or more copies may be obtained at ten cents a copy.

THE READER'S MARKET

A place where members of the American Nature Association and readers of Nature Magazine may find many interesting offerings or may advertise themselves, at low cost, for things wanted; things they have for Sale, for Trade, for Sale or Trade. This is an excellent forum for acquiring or disposing of such items as binoculars, books, cameras and photographic equipment, magazines, sports and outdoor equipment, etc.

BINOCULARS and FIELD GLASSES

BINOCULARS, TELESCOPES, MICROSCOPES. Our 20th year of leadership in optical values. Bargain catalog free. Brownscope Co., 24 West 45th Street, New York.

SAVE 50% ON NEW BINOCULARS! Free Catalog. Free book, "How to Select Binoculars." Write today! Bushnell's, 43-N31 Green, Pasadena 1, California.

BOOKS

NATURAL HISTORY BOOKS. Out-of-print. Astronomy, Meteorology, Geology, Botany, Gardening, and Zoology. Catalogs issued. John Johnson, R.F.D. No. 2, North Bennington, Vermont.

POWERFUL MENTAL TELEPATHY. Unlimited Free literature. Joseph Johnson, Globe Road, Lewisburg, Tenn.

BOOKS! Hard-to-find and out-of-print or speciality. All subjects. Send Wantal Jaher Book Service, 620-N. East 178th St., New York 57.

SECURE YOUR OUT-OF-PRINT books from the Audubon Book Service, Dept. N - 415 Lincoln Avenue, Brooklyn 8, N. Y.

BOOKS ON BIRDS. Mammals, Reptiles, Trees, general nature subjects. Catalog sent on request. Pierce's, Winthrop, Iowa.

BOOKFINDER. Any book. Send wants. Falconry specialist. Hecht, Box 4206-N Tower Grove Station, St. Louis 16, Missouri.

BUSINESS OPPORTUNITIES

FAULOUS EARNINGS — Fascinating pastime. Growing Genuine living miniature (Ming) trees. New sensational Business or Hobby. Astonishing information FREE. Dwarf Gardens, Box 355X, Briggs Station, Los Angeles 48, Calif.

BUTTERFLIES

FOR SALE: — Fifty thousand butterflies, twelve tropicals including one Blue Morpho \$2.00. List free. Ben Karp, 3148 Foothill, La Crescenta, California.

LIVING COCOONS: \$2.00 per dozen. Largest selection of living cocoons in the nation. List sent on request. Melville Osborne, 2100 Price St., Rahway, New Jersey.

INDIAN RELICS

4 PERFECT ANCIENT INDIAN Arrowheads \$1.00. Fine Stone Tomahawks \$2.00 & \$3.00. 4 Fine Bird Arrows \$1.00. List Free. Lear's, Glenwood, Arkansas.

KODACHROMES

KODASLIDES of western nature subjects, National Parks, or Monuments, rented for programs or sold on approval. Describe interests. Nesbitt's, 711 Columbia Road, Colorado Springs, Colorado.

MISCELLANEOUS

HOME FLOWER ARRANGEMENTS — Interesting, unusual dried desert, mountain flora. Create beautiful, attractive arrangements alone or with flowers in your home. Send for prices, descriptions. Mel Capper, Box 70, Palm Springs, Calif.

YOUR LEATHER JACKET renovated expertly. Free Circular. Berlew Mfg. Co. Dept. 30, Freeport, N. Y.

PUBLISHING SERVICES

LOOKING FOR A PUBLISHER? Write for free booklet NT telling how we can publish your book. All subjects considered. New authors welcome. Vantage Press, 230 W. 41st, New York.

ROCKS and MINERALS

ROCKS and MINERALS (magazine for collectors). If you collect rocks, minerals, sands, pebbles, crystals, ores, gems, *Rocks and Minerals* is your magazine. Founded 1926. Issued once every two months, 112 pages per issue, \$3.00 a year (sample copy 60c). *Rocks and Minerals*, Dept. N, Box 29, Peekskill, N. Y.

FOR YOU — A new year, a new hobby. From out of the desert, one dozen splendid, mounted mineral specimens you'll be proud to own. Choice collection includes Fool's Gold, Garnet, Onyx, Chrysocolla, Bornite, etc. Send One dollar bill to: Desert Stones, P.O. Box 5445, Tucson, Arizona.

SEA SHELLS

SEA SHELLS. Nature's Treasures of the Sea, appeal to Hobbyists. Lists of \$1.00 to \$5.00 Specials on request; 5 Odd Marine specimens \$1.00; write for free lists today. Mrs. F. K. Hadley, 48 Adelia Ave., West Newton, Mass.

SEA SHELLS FROM Burch mean much to collectors seeking fine scientific material, both beautiful and rare from the world's seas. John Q. Burch, 1584 W. Vernon, Los Angeles 62, California.

STAMP COLLECTING

50,000 STAMP GRAB BAGS, 25c each. Anderson, 630 Bingham, Reading 11, Penna.

FREE! BIG UNITED STATES catalog! Invaluable guide and check list. Hundreds of illustrations. Harris & Co., Boston 17-Al, Mass.

"HOW TO RECOGNIZE RARE STAMPS." Free book profusely illustrated. Write today! Kenmore, Milford, H88, N.H.

TELESCOPES

SKYSCOPE, the full 3 1/2" reflector, price — \$25.00. Sixty power, Q wave aluminized mirror, equatorially mounted, ready for use. Guaranteed observatory clearness. Used by schools, universities. Straight-forward descriptive literature on request. The Sky-scope, Company, Inc., 475N Fifth Avenue, New York 17, N. Y.

WRITING

SELL IN THREE MONTHS OR MONEY BACK. If you can write correct English — You can write Juveniles. I have sold some 300-3500 stories, articles... editorials... serials... series. Now I'm teaching. "Instruction — Criticism — Collaboration." Write Dept. N for terms. Will Herman Author of "My Juvenile Success Secrets" and "My Formula for Fiction." 7016 Euclid Ave., Room 328, Cleveland 3, Ohio.

I WANT NEW WRITERS to cash checks of \$1 to \$100 offered daily. The easiest way to write for pay. No previous experience necessary. FREE DETAILS. Saunders M. Cummings, 468-12 Independence Bldg., Colorado Springs, Colo.



Listen!... wherever women get together, the new motion picture, "Breast Self-Examination" is news! At neighborhood centers, in factories and at organization meetings, we are showing this film to countless thousands of American women.

For information call the American Cancer Society office nearest you, or address your letter to "Cancer," care of your local Post Office.

American Cancer Society



Yosemite Field School

It is a mighty select group that makes up the student body of the Yosemite Field School, a workshop in interpretive methods held under the direction of the National Park Service Naturalist Division. Twenty selected college graduates make up the class, which receives intensive and varied training in the presentation of natural and human history to the public, and in the techniques of interpretation. Deadline for applications is February 28, 1952, and full information is available from Director, Yosemite Field School, Box 545, Yosemite National Park, California.

Country Poet

We seem to have missed the first issue, but the second issue of an attractive little poetry magazine called *The Country Poet* has come to hand, and, being poetry conscious, we have read it with interest. It is devoted to poetry of farm, field and stream and is published quarterly at one dollar a year by Edwin P. Geauque, Sanbornville, New Hampshire. The publisher believes that such a publication can be made to pay its way, and pay its poets. We wish him well.

Forest Progress

"Progress of Forestry — 1945 to 1950" is the report of the Forest Progress Committee of the American Forestry Association, 919 17th St., N.W., Washington 6, D. C., and an important and useful contribution to conservation literature. This report is, in fact, a collaboration of many individuals, representative of many organizations in the conservation field. A great deal of factual material is concisely presented, and a great deal of valuable data is available in tabular form. Copies are available at three dollars each, or at lesser prices for quantities.

Of Southern Forests

Again this year the Southern Kraft Division of International Paper Company, 220 East 42nd St., New York 17, New York, makes a report to the people of the South on the program and problems of maintaining the timber crop as a permanent resource. Together with this report is another in the excellent series of picture booklets with a conservation message, a booklet that makes effective use of the so-called "comic book" technique. The booklet this year is entitled "The Crop that Did Not Fail." It, together with a teacher's guide, is available from the International Paper Company on request.

Forest Cooperation

A cooperative program between the Iowa State Conservation Commission and Iowa State College at Ames will emphasize research on production, management and use of Iowa forest lands. The college has been conducting studies on such lands since 1909, and the Commission is charged

with the administration and supervision of the State's forestry program. The new agreement, which became effective October 1, bring the facilities of both groups to focus on the problem of how to manage Iowa forest lands for the maximum benefits and returns to the individual landowner and the people of the State.

A Record Visitation

According to figures released by the National Park Service, 36,679,316 persons visited the national parks, national monuments and other areas administered by the Service during the travel year that ended September 30, 1951. This represents approximately 12 percent more visitors than last year. Most visited National Parks are Great Smoky Mountains in North Carolina and Tennessee, and Shenandoah in Virginia. Both Rocky Mountain National Park and Yellowstone also recorded more than one million visitors.

Magazines Waterlogged

Through the years Ralph J. Donahue, Route 6, Butler, Missouri, has saved copies of *Nature Magazine*, both for rereading and reference. His home was, and still is, in Kansas City, Kansas, and, when warning of flood came, as many things as possible were carried to the second floor of his two-story home. But that was not enough and, along with books and other possessions, the copies of the magazine were ruined. He says he feels lost without the accumulation of years, and wonders if there is anyone who plans giving away back numbers. If so, he is in a receptive mood.

Seeking Truth

The Secrets of Religion Down through the Ages and One World in Religion. By Russell Forest Egner. Minneapolis 19, Minn. The Religious Generations Foundation. 632 pages each. Illustrated. \$12.50 the set.

Lovers of Nature and the outdoors, as a rule, are deeply religious, not necessarily in the ritualistic, dogmatic, creedal way, but with a profound belief in a Supreme Being and a humble faith in the eternal verities. Indeed, whatever a man's doctrinal religious beliefs, a knowledge of Nature and the outdoors deepens his faith and broadens his comprehension.

Aryan poets 3500 years before the founding of Christianity composed sacrificial hymns and became priests. Marveling that all the rivers flowing into the ocean never filling it; asking why the shining sun does not tumble from its place in the sky; the Vedic poets who made these songs lifted their voices; in praise of the forces of the universe — the shining sun, the starry sky, the fires on the hearth. No parts of the Bible move men and stir their hearts as universally as do certain simple and familiar passages in the Psalms: "The Lord is my Shepherd; I shall not want. He maketh me to lie down in green

pastures; he leadeth me beside the still waters." or "I will life mine eyes unto the hills, from whence cometh my help."

Whatever a man's faith or denomination, he should profit by knowing a little about other world religions. Modern scientific thought has exposed many old superstitions and anciently conceived beliefs. In "one world" we can only know one another if we know one another's beliefs. These are truly ambitious works — informative, inspirational books you will want to study and not just read.

Whoops! Sorry

Somehow a couple of wrong prices crept into a newsnote and a review. We quoted *A Guide to Bird Finding* by Pettigill, published by Oxford University Press at four dollars, and it should have been five. Somehow, also, we got the idea that the price of the Optical Star Finder, devised and sold by TriGco, Linden, Missouri, was one dollar. It should have been obvious that it could not have been produced for that. The price is \$2.50.

Briefly Noted

Spinoza Dictionary. Edited by Dagobert D. Runes, with a foreword by Albert Einstein. New York. 1951. Philosophical Library. 309 pages. \$5.00.

While Spinoza's works may intimidate the average reader who seeks to learn from this great thinker, this A.B.C. exploration of the philosopher's thoughts makes knowing him easier.

Astronomy of Stellar Energy and Decay. By Martin Johnson. New York. 1951. Dover Publications. 216 pages. Illustrated. \$3.50.

A general reader's outline of facts and theories about the life-history of stars, and a student's introduction to their radiation, steady or varying or catastrophic.

A Stamp Collector's Encyclopaedia. Compiled by R. J. Sutton. New York. 1951. Philosophical Library. 263 pages. Illustrated. \$3.75.

Some three thousand references to terms and names that appear in the course of pursuing the hobby of stamp collecting.

The Pleasure of Being Oneself. By C. E. M. Joad. New York. 1951. Philosophical Library. 205 pages. \$3.75.

An amusing discussion of the pleasures of everyday life, hobbies and otherwise.

Quantum Theory of Matter. By John C. Slater. New York. 1951. McGraw-Hill Book Company. 528 pages. \$7.50.

This is a distinguished addition to textbooks in the field of the physicist by a Professor of Physics at the Massachusetts Institute of Technology.

Little Giant

Little Giant. By Olive Knox. Toronto, Canada. 1951. The Ryerson Press. 196 pages. Illustrated by Clarence Tillenius. \$2.75.

This is an historical novel of the early days of the Hudson's Bay Company, and about a boy named Henry Kelsey who came to Canada at the age of fourteen to join the company. It is written for boys and girls of about Henry's age, and is packed with adventure.

Stories in Pictures

Our Dumb Animals, 180 Longwood Avenue, Boston 15, Massachusetts, announces its annual photographic contest that seeks "story-telling pictures of wild or domestic bird and mammal pictures. Cash prizes amounting to \$160 are offered and full information about the contest, which closes June 15, 1952, may be obtained at the address given above.

Forest Products History

Announcement is made by the Minnesota Historical Society, St. Paul 1, Minnesota, of the formation of The Forest Products History Foundation to serve as the national repository of American forest history. In the foreword to a booklet, a copy of which may be obtained from the Society, describing the objectives of the Foundation, we find the following interesting conception:

"The ring of the ax and the hum of the saw sing the great ballad of America's growth. Today's historians are coming to hear that ballad more clearly; and this growing interest in the history of our national forest products has created an exciting and challenging field for co-operative study.

"Even the most casual review of United States history shows how inseparable are the stories of our cities, industries, and population movements and the story of logging and lumbering. How would John Paul Jones have fought without the stout support of the men who gave him wood for his ships and the pitch, tar, and turpentine to fabricate them? How would Chicago have grown to greatness without the products of the vast forests of our mid-continent? How would the empire builders have flung railroads across the land without millions upon millions of wooden ties?

"But history waits for no man. Even now, much of the rich detail of American forest lore is dimming and disappearing. The great pioneer loggers are dead and gone. The writings and records and drawings and photographs of our most significant lumbering eras are in danger of being lost. But there is one group enthusiastically pledged to restoring and preserving this important record of our national life."

All the wonders of nature are yours in PUTNAM'S NATURE FIELD BOOKS

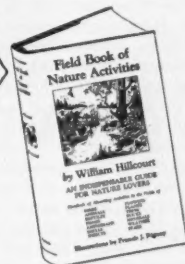
Putnam's Nature Field Books Have Stood the Test of Time! Authoritative, Accurate, Easy-To-Use, Magnificently Illustrated.

This celebrated series is, beyond comparison, the finest group of books on nature ever published. Thousands acclaim them

as unsurpassed for accuracy, beauty, and complete usefulness. There is a NATURE FIELD BOOK for every subject and use.

As an example
HERE'S THE LATEST FIELD BOOK
More Than 500 Things To Do!

FIELD BOOK OF Nature Activities By WILLIAM HILLCOURT (National Director of Scoutcraft)



Only \$3.95

It contains hundreds of specific and practical suggestions for projects — things to do — things to make. It's a wealth of ideas for every conceivable nature hobby, including a special section describing the taking of nature photographs. It's a how-to book you'll use a thousand times over — and it's illustrated profusely with drawings and diagrams.

There's a Field Book for Every Need:

- FIELD BOOK OF SEASHORE LIFE — \$6.00
- THE SHELL COLLECTOR'S HANDBOOK — \$4.00
- FIELD BOOK OF EASTERN BIRDS — \$3.95
- FIELD BOOK OF WILD BIRDS AND THEIR MUSIC — \$3.95
- BIRDS OF THE OCEAN — \$5.00
- BIRDS OF THE PACIFIC COAST — \$5.00
- FIELD BOOK OF AMERICAN WILD FLOWERS — \$3.95
- FIELD BOOK OF WESTERN WILD FLOWERS — \$3.95
- FIELD BOOK OF AMERICAN TREES AND SHRUBS — \$3.95
- FOREST TREES OF THE PACIFIC COAST — \$5.50
- FIELD BOOK OF COMMON MUSHROOMS — \$3.95
- FIELD BOOK OF COMMON FERNS — \$3.50
- FIELD BOOK OF COMMON ROCKS AND MINERALS — \$3.95
- FIELD BOOK OF NORTH AMERICAN MAMMALS — \$5.00
- FIELD BOOK OF ANIMALS IN WINTER — \$3.95
- FIELD BOOK OF INSECTS — \$3.95
- A LOT OF INSECTS — \$3.50
- FIELD BOOK OF PONDS AND STREAMS — \$3.95
- FIELD BOOK OF SNAKES IN THE U.S. AND CANADA — \$3.95
- FIELD BOOK OF MARINE FISHES OF THE ATLANTIC COAST — \$4.50
- FIELD BOOK OF GIANT FISHES, WHALES, AND DOLPHINS — \$5.00
- FIELD BOOK OF NATURE ACTIVITIES — \$3.95
- FIELD BOOK OF THE SKIES — \$3.95
- FIELD BOOK OF THE STARS — \$3.00
- A BEGINNER'S STAR BOOK — \$5.00
- BEGINNER'S GUIDE TO WILD FLOWERS — \$3.50
- A BEGINNER'S GUIDE TO THE STARS — \$2.00
- BEGINNER'S GUIDE TO SEASHORE LIFE — \$2.00
- BEGINNER'S GUIDE TO FRESH-WATER LIFE — \$2.00
- STORY OF PLANTS — \$5.00

**SEND
FOR
FREE**

Illustrated
Catalogue
of all the
Nature Field
Books

MAIL THIS COUPON NOW!

AMERICAN NATURE ASSOCIATION
WASHINGTON 6, D. C.

Enclosed is \$ (check or money order). Please send me the NATURE FIELD BOOK(S) I have listed below:

Name _____
Address _____
City _____ State _____

UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON

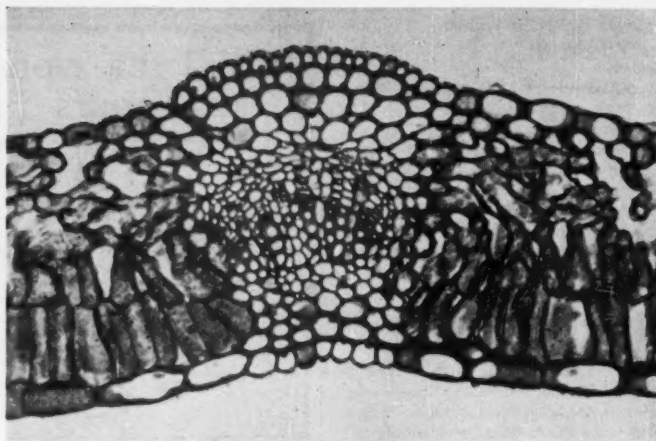
GREEN LEAF

(Photomicrographs from slides loaned by Ward's Natural Science Establishment, Inc.)

RED blood, yellow sun, green leaf, blue water, brown earth — this is the spectrum of life. In the grand cycle of energy, as it has been worked out on our planet, almost the only constructive agency is the green leaf, the great factory that makes the food upon which all living forms ultimately depend. Fungi and animals are all destructive, tearing down what the green plant has built, either primarily, as a cow eating grass, or secondarily, as a lion eating the cow, or man drinking the cow's milk. In the happier days of a bygone era, man also ate the cow.

Green leaf in Greek is *chlorophyll*, and every young scholar learns that this is the name of the chemical substance responsible for making leaves and young stems green in color, so that earthly landscapes are predominantly green, and that this material is a pigment found in minute oval bodies or plastids called *chloroplasts*. By means of chlorophyll, a small but sufficient portion of the radiant energy of sunlight is absorbed by cells of leaves, and it is this energy that puts together the water and carbon dioxide molecules to make the glucose molecule, a simple sugar that then may be condensed to a more complex sugar, or a starch, fat, or protein.

The green leaf, then, is the primary food factory of the world, ample justification for a pardonable curiosity on our part, to wish to probe the secrets of its construction and operation.



Lilac Leaf, c.s., 400X.

Of the several kinds of leaves, the most numerous sort are those of dicotyledonous plants, or dicots, embracing the great majority of flowering plants, in which the leaf typically consists of a thin, flat, broad *blade*, supported by a short stem, the *petiole*. The blade exhibits a *midrib* or principal longitudinal vein, with paired series of side veins, termed *pinnate venation* (elm), or else has *palmate venation* (maple), with veins radiating from the base of the blade like the fingers of a hand. In either case there are cross and branched veins to make a complex interlacing pattern described as *netted venation*. These leaves are classified, as to shape, as lanceolate, ovate, palmate, and so on, and as to whether simple or compound, the latter being one that is cut up into leaflets, and there are still other ways of cataloging their appearance.

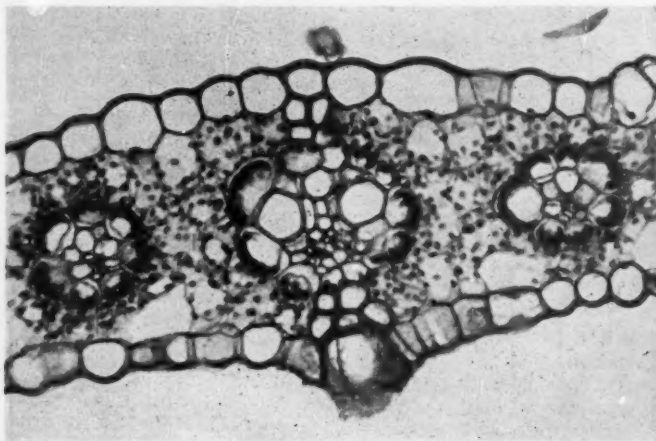
Monocot leaves, or those of monocotyledonous plants, have *parallel venation*, without a main midrib, and this type is well seen in corn or iris. A third category is that of the gymnosperms, best known of

which are the conifers, as pine and spruce. The pine needle is a specialized leaf of great interest for comparison with a broad-leaf. There is a separate chapter dealing with the arrangement of leaves upon a shoot, and another on modified leaves, such as spines and tendrils, concerning which we shall have to go botanizing again in a later issue.

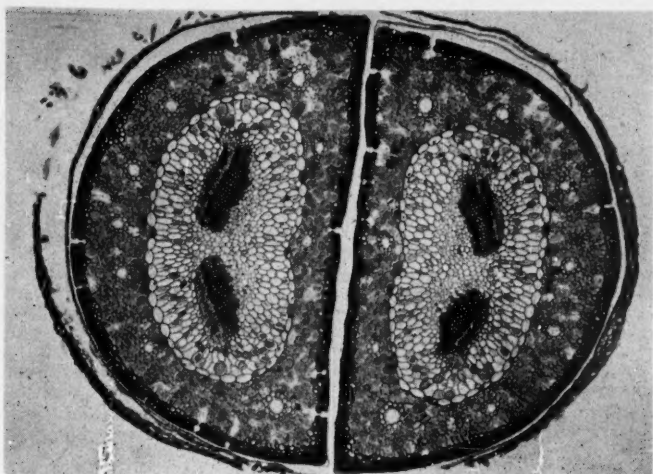
For the present, our concern is to relate structure to function in a survey of the microscopic anatomy of leaves. If we begin with the dicot broadleaf, as the much-studied lilac leaf, we note that both upper and lower surfaces of the blade consist of an *epidermis* of a single layer of cells. With care, this layer may be stripped off and mounted flat, and this is customarily done to reveal the *stomata* or *stomates*, singular stoma (mouth) or stomate, minute openings through the epidermis for the passage of gases. Each stoma is the space between two bean-shaped *guard cells*.

The number of stomata in a single leaf is astoundingly large. Fuller and Tippo give 175 stomata per square millimeter for the upper epidermis of a sunflower leaf, 325 for the lower epidermis. They calculate 1,950,000 for the lower surface alone of a single leaf of this plant. One investigator figured that when all stomata in the lower epidermis of a given leaf were fully open, the pores represented slightly under one percent of the total area, a statement that gives an idea of their extremely minute size. Olive and birch are cited as examples of plants that have stomata on the lower epidermis only.

The guard cells contain chloroplasts and are green, but otherwise chlorophyll is absent from the epidermal layers. The ordinary surface cells have their outer walls, as a rule, thickened and impregnated with *cutin*, a wax that sheds water and protects leaf tissues from various injuries. If the wax is present as numberless minute plates, the leaf surface has a bloom, as in cabbage. Hairs, from simple outgrowths of a single epidermal cell, to multicellular and compound structures,



Corn Leaf, c.s., 450X.



Pine Leaves, c.s., 60X.

may be present, mullein being a well-known species with dense pilosity of its leaves. Sometimes the hairs are glandular and secrete fluids. These may be volatile oils, as in the mint family.

Between the two layers of epidermis, all tissues other than the veins comprise the *mesophyll*, meaning the middle of the leaf. First, starting from the upper epidermis, comes the *palisade* layer, with usually one, sometimes two rows of elongate vertical cells; then the *spongy* layer. The cells of both of these parts of the mesophyll contain chloroplasts and constitute the actual sugar factory. To a slight extent in the palisade and to a large extent in the spongy layer, the cells are separated by *air spaces*, which make possible the diffusion of gases throughout the leaf tissue and evaporation of water from cell surfaces. These spaces are in communication with the substomatal chambers, and thence with the exterior.

Entering via the petiole is a *vascular bundle*, which proceeds to branch and subdivide throughout the leaf as the system of "veins," so called in analogy to the blood vessels of man. These are direct continuations of the same structures in root and stem, and constitute the transportation system of the plant, carrying water and minerals upward from the root and the food made in the leaf back toward the main body of the plant. Foods are not necessarily sent downward, as is generally stated. The movement of foods here and there in the plant is termed *translocation*, and is toward a region where a food or foods are in demand — downward for storage in a root, upward for use by growing points, as a developing flower bud. The water-conducting tissues consist of tracheids and vessels and make up wood, termed *xylem*, while the food-conducting channels are mostly sieve tubes, and constitute *phloem*. In the stem, *xylem* is toward the central pith, *phloem* toward the exterior; accordingly, when

a portion of this tissue leaves the stem to run out into a branch, then a twig, and eventually a leaf, continually subdividing as it goes, the *xylem* is upper and the *phloem* lower in position. Thus in a cross section of a leaf blade, the *xylem* is on top in the section of each vein. The walls of *xylem* elements are thick and stain red with safranin, while the *phloem* tubes are thin-walled and stain green when fast green is used. The double staining combination of safranin and fast green is a favorite in preparing sections of root, stem, or leaf. Around these conducting tissues is a *bundle sheath* of small cells containing chloroplasts.

In a section of corn leaf, as a representative of monocots, with parallel venation, the epidermal cells are seen to be very large, with thick outer walls, and no chloroplasts. The guard cells are small and numerous, there being many stomata on both upper and under surfaces. The only air spaces are the substomatal, which are large; otherwise the cells are small, compact, full of chloroplasts, and not differentiated into palisade and spongy layers.

The pine needle does not look much like the preceding leaves, but nevertheless is the leaf of the pine tree and its cross section reveals the same general construction, although the details and arrangements differ. The needles are borne at the ends of very short spur or dwarf branches, which arise from the long branches, and occur in clusters of two to five in most species. Scotch pine and Austrian pine are both two-needle species, one such doublet being shown sectioned in an accompanying illustration. Each leaf is described as acicular, meaning needle-shaped, and elongate, green, but without any division into petiole and blade. No veins are externally visible, but there are two prominent ones deep within, as the section reveals.

Some of the language handed down from

SAVE 50%

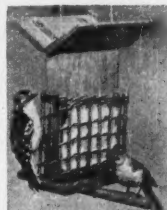
World's Greatest BINOCULAR VALUES

See BUSHNELL'S 33 Models NEW FREE CATALOG! **17.95 UP**

Guaranteed to give you more and save you money on every popular model. Don't overpay! Compare BUSHNELL'S before you buy. Send for FREE CATALOG and

Free Book! How To Select Binoculars!

BUSHNELL Binoculars Dept. 661 Bushnell Building Pasadena 1, Calif.



ATTRACT
WILD BIRDS
TO YOUR
GARDEN
WITH OUR
PATENTED
AUTOMATIC

EYE-SAFE FEEDER
\$3.50 Postpaid

FEEDERS

Write for free folder on various other feeders

audubon workshop

INCORPORATED
4931 N. Kentucky

DEPT. AN
Chicago 38, Ill.

The Ten-Year Index

(Volumes One to Twenty)

makes Nature Magazine a textbook. Order yours now . . . 50c

AMERICAN NATURE ASSOCIATION
1214 16th St., Washington 6, D. C.

Free Book on Arthritis And Rheumatism

HOW TO AVOID CRIPPLING DEFORMITIES

An amazing newly enlarged 44-page book entitled "Rheumatism" will be sent free to anyone who will write for it.

It reveals why drugs and medicines give only temporary relief and fail to remove the causes of the trouble; explains a specialized non-surgical, non-medical treatment which has proven successful for the past 33 years.

You incur no obligation in sending for this instructive book. It may be the means of saving you years of untold misery. Write today to The Ball Clinic, Dept. 543, Excelsior Springs, Missouri.

Tells How You Can Learn to MOUNT BIRDS!

FREE BOOK

Learn At Home

Men, Boys, Hunters, Fishermen, mount and save your lovely wild-game trophies. Be a Taxidermist! Mount Skins, Animals, Heads, Fish, Yarn skins. YOU save easily, quickly in spare time. Have a grand home-companion. The finest and the greatest book known for sportsmen. Fun, real profits.

FREE BOOK

You, FREE, beautiful strange, valuable books, tell all about Taxidermy. Contains over 100 beautiful game pictures. And it's yours FREE, if you rush your request. You can positively TEACH YOU. So GRAB this opportunity. Rush letter or postal for this amazing FREE BOOK. Don't delay. State your AGE. K. W. SCHOOL OF TAXIDERM, 6101 Elwood Bldg., Omaha 2, Neb.

Mention NATURE MAGAZINE when answering advertisements

an earlier day in botany is still in use in discussing plant tissues, particularly in leaves and more particularly in the pine needle. The terms use the Greek *enchyma*, infused or poured in, with prefixes denoting the characteristic of specific tissues. The fundamental or ground tissue is *parenchyma*, used for soft and thin-walled, unspecialized cells, as the mesophyll of leaves or the pith of stems. *Chlorenchyma* is any form of plant tissue containing chlorophyll, no matter if in leaf, stem, or root; so palisade cells of leaves are at one and the same time parenchyma and chlorenchyma. *Sclerenchyma* (skleros, hard) indicates skeletal tissues, for support, as xylem elements, while *collenchyma* (kolla, glue) consists of soft cells which retain their living protoplasm, but whose walls are thickened only at certain places, notably at the angles.

The epidermis of the pine needle has a heavy cuticle at the surface and is underlain by several rows of sclerenchymatous cells, staining darkly. Then comes the chlorenchyma or mesophyll, the cells of which are peculiar in having lobes, with infoldings that represent greatly restricted air spaces; the general impression is that of a solid mesophyll, but the spaces are there if one looks closely. Cross sections of numerous large resin ducts are seen in the mesophyll. Next within there is a single row of large cells, the *endodermis*, inside which are two vascular bundles, lying in a considerable parenchyma. The xylem is situated, in each bundle, toward the flat side of the leaf, the phloem toward the curved side.

Turning to the functional aspect, the leaf is the plant organ that performs the major portion of two principal activities — photosynthesis and transpiration. In common with other plant tissues and organs, leaf cells may digest and assist in the translocation of foods, and perform respiration, releasing energy for use in growth, reproduction, movements, and in other ways.

There is an intermittent flow of water through a plant that involves astonishing quantities. Water from the soil passes into the root system, thence via the xylem up the stem and out the branches to all the leaves. Here liquid water diffuses into the mesophyll cells, continuing to their outer surfaces, bordering the air spaces. Under most conditions — the principal exception being when rain is falling and the air is fully saturated with moisture — evaporation from the wet cell walls of the interior of the leaf occurs, water passing into the air spaces and then the sub-stomatal spaces as water vapor, thence out through the stomata. This is *transpiration*. During the life of a corn plant — roughly 100 days — it will give off more than fifty gallons of water, and an acre of corn will during this period transpire more than 300,000 gallons, weighing some 1200 tons. No wonder then that growing plants have marked effects on the humidity of the atmosphere and hence upon climate

and rainfall. When a community or state, through greed or indifference, allows selfish commercial interests to come in and remove the forest mantle from the land on which we live, the results are soil erosion, drought, economic ruin and, as the last chapter, the desert.

Carbon dioxide enters the plant leaf through the stomata, and the molecules of this atmospheric gas go into solution in the film of water covering the surfaces of the mesophyll cells and then pass through into the cell substance by osmosis. In these cells the carbon dioxide and water molecules are combined, using the energy absorbed from sunlight by the chlorophyll. This putting together by means of light energy is *photosynthesis*. Full details of most of these life processes are unknown.

With the water from the soil come minerals, essential in building proteins and such substances as chlorophyll. For example, magnesium is an element that is present in the chlorophyll molecule, while iron is not; yet both of these metals are necessary if chlorophyll is to be manufactured in the leaf. Aristotle, in the absence of knowledge of gases, believed that the plant obtained all of its food from materials in the soil, and this idea, termed the *Humus Theory*, remained current long after it was disproved. The Belgian physician, Jean van Helmont, in the Seventeenth Century, kept a willow tree in a tub of earth and water for five years, adding only rainwater during that time. At the end the tree had gained about 164 pounds, and the soil in the tub had lost only two ounces, showing that the gain, as van Helmont thought, had come from the water. He did not know of the addition of carbon from atmospheric carbon dioxide. Today we know the role of chlorophyll, all important in the work of the green leaf. Tomorrow we may have found out how to do the same thing in a man-made factory, a step toward complete mastery over nutritional requirements of man.

BEGINNER'S PRIMER

OUR tour of fly families has now reached that station where we may trot out those groups whose members more or less resemble house flies and are hence termed *musoid*, the common housefly being *Musca domestica*. First is the Family Anthomyiidae, the name meaning flower-flies, a scarcely appropriate moniker. Another designation is root-maggots, referring to the fact that in some species the larvae feed on roots. Very serious pests occur here, as the onion maggot, cabbage maggot, raspberry cane borer, the beet or spinach leaf-miner, and many others.

The lesser housefly, *Fannia canicularis*, and the latrine fly, *F. scalaris*, are well known in the field of medical entomology, as their larvae are occasionally noted as accidental parasites of man, an infection called *myiasis*. Parasitologists generally pronounce this word my-eyé-a-sis, although Webster gives mi-ya-sis. Eggs,

accidentally swallowed, may develop into larvae within the digestive tract; urogenital infection is also possible. Some of these cases are stubborn and difficult to cure. These flies are European species, now widely distributed in North America; both are cosmopolitan today in the warmer regions. *Fannia canicularis* has three dorsal thoracic stripes instead of the four of *Musca domestica*. The arista is naked, while in *Musca* it is plumose. The legs are black, the halteres yellow. Eggs are laid in decaying vegetation, notably in piles of grass cuttings, as well as in manure. The larvae present an unusual appearance, being widest in the middle, tapering toward both ends, and have four rows of spines, two dorsal, two lateral. *Fannia scalaris* is similar but larger. The median dorsal band on the abdomen is interrupted, resulting in the appearance of a row of triangular spots. The dorsal rows of spines of the larva are reduced, the lateral spines are feathery. Either eggs or larvae on decaying fruit may be swallowed by persons who are not particular in their eating habits, or by children. Other contaminated food may be involved, or infection may occur by deposition of eggs by the fly on or near exposed parts.

Most anthomyiids are the size of a housefly or somewhat smaller, and resemble this cosmopolitan pest in general appearance. They are black, gray, or tan, with large heads, large eyes, and hairy body. A type seen in immense numbers by visitors to the shore is the kelp fly, *Fucellia fucorum* (Atlantic) or *F. rufitibia* (Pacific) found on the seaweed cast upon the strand.

The Family Glossinidae comprises the dread Tsetse Flies of Africa, vectors of African sleeping sickness of man and other infections of his domestic animals. This group is of sufficient importance as to warrant a separate feature article, and the same is true for the principal incumbent of the Family Muscidae or houseflies, so we may pass now to the Family Stomoxyidae. If you have ever been bitten by what you took to be a housefly, then you have made the acquaintance of *Stomoxys calcitrans*, the biting housefly. This very annoying bloodsucker has biting mouthparts instead of the fleshy proboscis of *Musca*, the abdomen is checkered, and the wings are held at an angle when at rest. The horn fly *Haematobia stimulans*, is easily collected by anyone on a farm that has cattle, as these flies gather in large numbers around the base of the horns of cows, also on the flanks. They, too, are vicious biters, very irritating to both wild and domestic animals.

Important slide mounts from groups discussed this month include antennae, mouthparts, wings, and legs of adults, and mouth hooks, spiracles, or whole mounts of larvae. The spiracles are known more commonly as *stigmatal plates* in fly larvae, and show a variable and specific pattern of slits, useful in diagnosing species. You will find descriptions and figures of these used in medical entomologies.

STOREHOUSE OF NATURE INFORMATION

Bound Volumes of NATURE MAGAZINE

Give you an indispensable
reference library on Nature sub-
jects available nowhere at
any price



HERE is an encyclopaedia of nature information which makes any other you could obtain -- a compilation of the material that has appeared month after month in NATURE MAGAZINE -- a wealth of fascinating stories about BIRDS, ANIMALS, FISHES, PLANTS, INSECTS, TREES, SEAS and other phases of Nature and the outdoors. It is really a treasure and unique in its scope and completeness. Every school, every library, every home will be enriched by possessing these valuable and attractive volumes.

Volumes 1 to 20 include six issues of NATURE MAGAZINE. Commencing with Volume 21, the issues are bound into attractive books. Volumes 1 to 19 are bound in dark green cloth with gold lettering. All subsequent volumes are bound in dark green half leather and stamped in gold.

This is an opportunity to secure these missing from your present set of bound volumes. Or, if you have not been keeping them, start now with a full set of those obtainable. No additional copies of these volumes can be had after those now on hand are gone. Volumes 1 to 20 (inclusive), have been completely sold. Copies of all other bound volumes are still available but going fast. Most of the missing volumes can be furnished in loose copies, prices furnished on request.

A BARGAIN AT THESE PRICES

Volumes 1, 11 to 20 \$3.00 each

Containing six issues

Volumes 21 to 30 \$5.00 each

Volumes 31 and up \$3.00 each

Containing six issues

Considering the illustrations these books contain, the many beautiful pictures and the double and quadruple illustrations, these are remarkable values.

Mail your order promptly, using the recognition card. Or write separately. If you do not wish an immediate acknowledgment.

AMERICAN NATURE ASSOCIATION
1214 Wisconsin Street, N. W., Washington 6, D. C.

Please attach the bound volumes of NATURE MAGAZINE checked below.

Amount \$..... in full payment to order.

10 in full payment to order.

20 in full payment to order.

30 in full payment to order.

40 in full payment to order.

50 in full payment to order.

60 in full payment to order.

70 in full payment to order.

80 in full payment to order.

90 in full payment to order.

100 in full payment to order.

MR. EUGENE B. POWER
UNIVERSITY MICROFILMS
313 N. 1ST ST.
ANN ARBOR, MICH.
18542 FREE

Captain Lewis L. Millett Model of Honor

When his company was pinned down by enemy fire near Ham-Mi, Korea, Captain Millett charged alone into the enemy positions, throwing grenades and clubbing and bayoneting the enemy. Inspired by his example, the attacking unit routed the enemy who fled in wild disorder.



"We can build our strength," says Captain Millett, "by taking a steady pace. Unfortunately, the only argument against respect to strength. Fortunately, we've learned this lesson in time."

"You can also build our strength—the strength of peace—by buying United States Defense Bonds. Every Bond is a declaration to the world—especially to would-be aggressors—that we stand for peace."

"Think a steady pace is worth working for? Buy U. S. Defense Bonds now!"

Remember that when you're buying bonds for national defense, you're also building a personal reserve of cash, without interest, too. But if you don't save regularly, you can't build your own cash reserve. Money you save today is money you can use up today. It's the only way to build your own cash reserve. Buy U. S. Defense Bonds now!

Peace is the way strong—
Buy U. S. Defense Bonds now!



The U. S. Government does not pay for this advertisement. It is furnished for information only and does not constitute an offer of insurance or any other financial product.